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# Employment of indications and warning methods to forecast potentially hostile revolutions in military affairs

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# THESIS

**EMPLOYMENT OF INDICATIONS AND WARNING METHODS TO FORECAST POTENTIALLY HOSTILE REVOLUTIONS IN MILITARY AFFAIRS**

by

Brent A. Morgan

September, 1995

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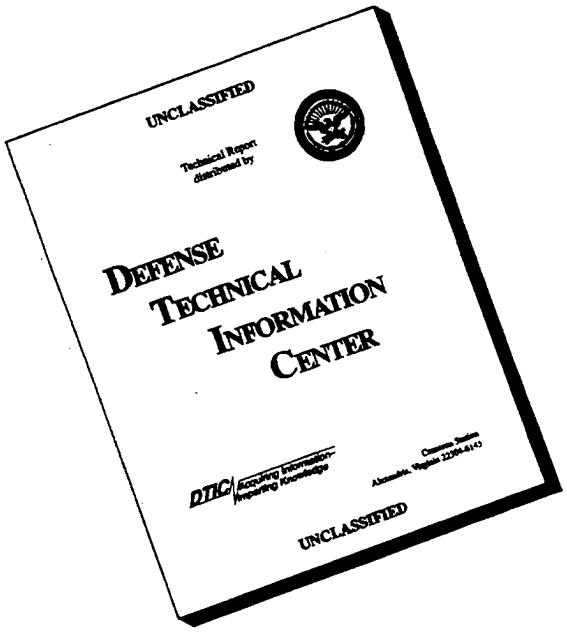


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The basic premise of a Revolution in Military Affairs is that changes in technology, doctrine, and organization have the capability to render existing methods of warfare obsolete. Two distinct visions of a future RMA are beginning to emerge within the defense community. The first involves the integration of precision guided munitions, and superior command, control, communications, computers, and intelligence (C4I) capabilities. The second vision is of information warfare. In this arena, the control and management of bits and bytes becomes more important than bullets.

Because of the potential advantages gained from the realization of an RMA, it is imperative that the United States detects, and accurately evaluates, any efforts by a potential adversary to achieve a RMA – whatever form it may take. Indications and Warning (I & W) intelligence is a process used by the intelligence community to detect indicators of potential threats while sufficient time exists to counter those same threats. This thesis examines "how" and "why" technology, doctrine, and organizations change in order to develop indicators that can be used to detect an emerging RMA.

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# EMPLOYMENT OF INDICATIONS AND WARNING METHODS TO FORECAST POTENTIALLY HOSTILE REVOLUTIONS IN MILITARY AFFAIRS

by

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# ABSTRACT

The basic premise of a Revolution in Military Affairs (RMA) is that changes in technology, doctrine, and organization have the capability to render existing methods of conducting warfare obsolete. Two distinct visions of a future RMA are beginning to emerge within the defense community. The first involves the integration of precision guided munitions, and superior command, control, communication, computer, and intelligence (C4I) capabilities. The second vision is of information warfare. In this arena, the control and management of bits and bytes become more important than bullets.

Because of the potential advantages gained from the realization of an RMA, it is imperative that United States detects, and accurately evaluates, any efforts by a potential adversary to achieve an RMA -- whatever form it may take. Indications and Warning (I & W) intelligence is a process used by the intelligence community to detect indicators of potential threats while sufficient time still exist to counter those efforts. This thesis examines "how" and "why" technology, doctrine, and organizations change in order to develop indicators that can be used to detect an emerging RMA.

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The author wishes to acknowledge the support and inspiration provided by his parents and brother. Of particular note is the 30 plus years of dedicated naval service by the author's father -- Thomas L. Morgan, Captain, United States Navy (retired).

# I. INTRODUCTION

## A. BACKGROUND

Many military analysts believe that the skillful use of advanced sensors, an integrated Command and Control Warfare (C2W) effort, and "smart" munitions by the U.S.-led coalition in the Gulf War, provided a glimpse of future warfare. Others contend that future "Information Wars" (IW) will be fought in the virtual world of "cyberspace" for control of a nation's financial and economic networks.[1] Still others, such as Andrew Krepinevich, assert that senior defense officials do not know how the next national security challenge will manifest itself.[2] All of these possibilities pose a critical problem for the United States. In past wars, the U.S. has had time to pursue and overtake enemies that started with superior technologies, doctrine, and organizational concepts. That luxury may not be available in future conflicts. As an example, we are now entering the information age -- which implies that tomorrow's wars will be fought more with bits than bullets. The force decisions that are made today will largely determine military capabilities over the next 10 to 20 years. In order to ensure that the U.S. military is capable of neutralizing future threats, irrespective of their form, it is imperative that revolutionary means of conducting warfare are identified as early as possible. Only by early identification of the threat can a full

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[1] Authors who have offered such scenarios include Winn Schwartau, *Information Warfare*, (New York: Thunder's Mouth Press, 1994) and Richard Power, *Information Warfare*, (San Francisco, CA: Computer Security Institute (CSI), 1995).

[2] Andrew F. Krepinevich is a an adjunct professor of strategic studies at the Paul A. Nitze School of Advanced International Studies, Johns Hopkins University. His views on future security challenges can be found in the article "Recasting Military Roles and Missions," *Issues in Science and Technology*, Vol. XI, No. 3 (Spring 1995), p. 41-48.

spectrum of options be developed and put in place to counter it. Failure to identify the threat could lead to a successful surprise attack and catastrophic losses on the battlefield.

## B. OBJECTIVE

The objective of this thesis is to suggest indicators, or warning events, that can be observed long before revolutionary capabilities appear on the battlefield. Early detection ensures a large number of available options exist to counter revolutionary capabilities. Obviously, the earlier and more decisive the warning, the greater the opportunity of countering the new capabilities. The indicators must be well conceived to ensure that false alarms are rare and legitimate threats can be timely noted and dealt with. This is a difficult task when technologies are changing at a rapid rate and new forms of warfare, such as C2W and IW, loom on the horizon.

## C. METHOD

The method used to develop these indicators is to apply the process of indications and warning (I & W) intelligence to the concept of a revolution in military affairs (RMA). The goal of indications and warning intelligence is to alert the intelligence analyst, and ultimately the policy-maker, to potential threats while sufficient time exists to prevent them from occurring or to lessen the effects if they do. Irrespective of the potential threat, I & W intelligence relies on two capabilities: (1) the ability to identify actions that must occur before the consequential event takes place and (2) the ability to detect and monitor those actions.

The basic proposition underlying a so-called "revolution in military affairs" is that enlightened changes in *technology*, *doctrine*, and/or *organization* can render previous methods of conducting warfare obsolete. Because of the unique status of the strategic situation, available resources, and status of technology, each revolution is different. Some favor the offense, some the defense; some stem from the introduction of a new weapon, others from a novel idea about how wars can be fought.[3] Whichever is the case, if a potentially hostile country or organization attempts to develop revolutionary capabilities, significant changes in at least one of the three vital components of a RMA, technology, doctrine, or organization, must take place prior to initiating hostilities. If the revolution is to realize its full potential, changes in all three of the components will take place.

An examination of how and why technology, doctrine, and organizations change should lead to a number of indicators of a developing revolution in military affairs. Those indicators can then be used to alert policy-makers of potential threats and prevent friendly forces from being surprised on the battlefield by a new weapon or new means of employing existing ones.

## D. FORMAT

This thesis is essentially divided into two parts. In Chapters II and III, the concept of a revolution in military affairs and the mission of I & W intelligence are explored. If the reader is thoroughly familiar with these two concepts, he or she may move directly to Chapter IV. In Chapters IV through VI, indicators are developed that could be employed

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[3] Michael J. Mazarr, *The Military Technical Revolution*, (Washington, D. C., The Center for Strategic and International Studies, 1993), p. 15.

by the intelligence community to forecast potentially hostile RMAs. This is done by examining why and how the three vital enablers of a RMA -- technology, doctrine and organization -- develop and change. The final chapter will offer some conclusions and areas of additional research.

# II. THE RMA CONCEPT

## A. COMPONENTS OF A RMA

### 1. Definition

The rapidly expanding interest in the idea that military affairs stand on the brink of a "revolution" has generated a number of terms that seek to describe this phenomenon. Therefore, the first step is to define both the term and the concept. For this thesis, the term "Revolution in Military Affairs" means a fundamental change in technology, doctrine, or organization that renders existing methods of conducting warfare obsolete.[1] Although a particular revolution may be weighted toward only one or two of the three components of a RMA -- technology, doctrine, or organization -- changes in all three are present in every revolution, and play a role. The other term which frequently appears in academic and professional publications, and describes the exact same concept as RMA, is "Military Technical Revolution," (MTR)[2]. Although technology plays an essential part in all RMAs, this term does not convey the complete scope of changes that comprise a total revolution. Additionally, as will be illustrated later, significant RMAs have taken place during times

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[1] Michael J. Mazarr, *The Military Technical Revolution: A Structural Framework*, (Washington, D.C.: Center for Strategic and Intenational Studies, 1993), p. 16.

[2] Authors using this term include Andrew F. Krepinevich, Jr., "Keeping Pace with the Military-Technological Revolution," *Issues in Science and Technology* Vol. X, No. 4, (Summer 1994), p. 23-29; Dan Goure, "Is There a Military-Technical Revolution in America's Future," *The Washington Quarterly* Vol. 16, No. 4, (Autumn 1993), p. 175-192; Paul F. Herman, Jr., "The Military-Technical Revolution," *Defense Analysis* Vol. 10, No. 1, (April 1994), p. 91-95; Kenneth F. McKenzie, Jr., "Beyond Luddites and Magicians: Examining the MTR," *Parameters* Vol. XXV, No. 2, (Summer 1995), p. 15-21.

when technology changed very little compared to previous wars. The term *RMA* will solely be used throughout this thesis when referring to a revolution which includes technological, doctrinal, and organizational changes. The term *MTR* will be used when referring only to the technical aspects of a revolution.

The common part of both expressions, "revolution," is justified by the parallels associated with political revolutions. Political revolutions are inaugurated by a growing sense, often restricted to a segment of the political community, that existing institutions have ceased adequately to meet the problems posed by an environment that they in part have created.[3] From a Marxist perspective, when the revolution does occur, the old system is not simply discarded; but a new and different system takes its place. The old does not disappear all at once; its usable parts remain. However, the only "old" that continues to exists is that which finds a useful place in the environment created by the new.[4] A military organization experiences a revolution in much the same way. New technologies, organizational structures, and doctrines that remain useful are incorporated into the new paradigm. Although this description of the revolutionary aspects of an RMA sounds relatively benign, the process can be every bit as difficult, painful, and have all the detractors found in a political revolution. Additionally, the failure to participate in a revolution can result in catastrophic defeat on the battlefield. The early nineteenth century European armies that initially opposed Napoleon are evidence of this.

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[3] Thomas S. Kuhn, *The Structure of Scientific Revolutions*, (Chicago: University of Chicago Press, 1962), p. 92.

[4] Harriet Fast Scott and William F. Scott, The Soviet Art of War: Doctrine, Strategy, and Tactics, (Boulder, Colorado: Westview Press, Inc., 1982), p. 123-124

## 2. Criteria

It is difficult to offer a single set of criteria that can provide a precise and definitive evaluation of what constitutes a revolution in military affairs. As noted by Jeffrey Cooper in *Another View of the Revolution in Military Affairs*, the many different concepts of an RMA being discussed has led to a situation similar to the parable of the blind men trying to identify an elephant while each is only touching one part.[5] The plurality of views not withstanding, the following are criteria used by the majority of authors to evaluate what changes in the military constitute a revolution.

- A change is revolutionary when it renders existing methods of warfare obsolete.[6]
- A change is revolutionary when it fundamentally alters the character and conduct of conflict.[7]
- A revolution is not based on the quickness of change, but on the magnitude of the change relative to preexisting military capabilities.[8]

A minority of authors, such as Alvin and Heidi Toffler, use stricter criteria. For them, revolutions in military affairs occur in conjunction with major societal, cultural, political, and economic changes.[9] Thus, the Tofflers contend that there have been three revolutions in the history of man -- the primitive to agrarian; the agrarian to the industrial;

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[5] Jeffrey R. Cooper, *Another View of the Revolution in Military Affairs*, (Carlisle Barracks, Pennsylvania: U.S. Army War College, 1994), p. 1.
[6] Michael J. Mazarr, *The Military Technical Revolution*, p. 16.
[7] Andrew F. Krepinevich, "Calvalry to Computer: The Pattern of Military Revolutions," *The National Interest*, No. 37, (Fall 1994), p. 30.
[8] James R. Fitzsimonds and Jan Van Tol, "Revolutions in Military Affairs," *Joint Forces Quarterly*, No. 4, (Spring 1994), p. 25.
[9] Alvin and Heidi Toffler, *War and Anti-War*, (New York: Warner Books, 1993), p. 19-28.

and the ongoing industrial to information revolution. Changes within these three revolutions would be characterized as evolutionary or progressionary advances.

In order to better grasp what constitutes a revolutionary change, the following characteristics of a Revolution in Military Affairs are offered:

1. That which was unquestionably an asset is now a potential liability. A vivid example of this is the revolution caused by the development of nuclear weapons. Before nuclear weapons, the massing of a large number of men and equipment was desired. However after nuclear weapons, large centrally located armies became extremely vulnerable to complete annihilation. The need for large armies did not disappear, but they did become much more vulnerable.

2. If the revolution is primarily technical, completely new doctrines and organizations are established to promote the weapon an its capability. Again, the nuclear revolution offers a vivid example. The Soviet Union formed an entirely new organization, the Strategic Rocket Forces, and designated it as the primary arm of the military as part of the nuclear RMA. This action was not unique. All of the original five countries that developed nuclear weapons (The United States, Great Britain, France, Soviet Union, and China) created elaborate command structures to ensure strict control and the capability to authorize their use at a moment's notice. Additionally, new doctrines such as Mutually Assured Destruction (MAD) emerged.

3. Failure to adopt the new revolutionary principles or effective counters all but guarantee failure on the battlefield. Napoleon's *Grande Armee* and corps system illustrates

this point. Hew Strachan states in *European Armies and the Conduct of War*, "As the Grande Armee passed its peak, its opponents began to assimilate some of the lessons of the Revolutionary Wars, and to incorporate them into their eighteenth-century dynastic armies."[10] As the innovations were incorporated, the British and Prussian armies began to enjoy successes on the battlefield.

## B. HISTORICAL EXAMPLES

To further ensure a common understanding exists as to what constitutes a revolution in military affairs, several historical examples of past RMAs are offered. Other than providing historical descriptions, the key purpose of these examples is to illustrate that significant changes occur in at least one of the three components that support a revolution in military affairs (technology, doctrine, and organization) in every case. Sometimes the most prominent aspect of the RMA is a new organizational structure; sometimes new technologies are primary, and sometimes new doctrine is at the forefront. However, as previously stated, all three pillars are present in every revolution, if only in a secondary role.

### 1. Napoleonic RMA

Modern examples of a Revolution in Military Affairs begin with Napoleon and the nation in arms. For the first time in history, the vast resources of a nation were used to equip and support a mass army. These resources were combined with a completely new

[10] Hew Strachan, *European Armies and the Conduct of War*, (London: George Allen & Unwin), p. 54.

and unprecedented structure: an army 150,000 strong organized into eight numbered corps, each containing units of all arms and each provided with a uniformly structured, though not exactly permanent, staff to direct its operations -- each a little army in its own right.[11] Although there were incremental increases in technology and the capability of certain weapons such as muskets and cannons, this revolution was almost totally based on changes in organization and doctrine. Training, organization, and doctrine -- all of them anchored the newly established democratic regime and in the lev'ee-en-masse -- were employed to overcome the technological limitations that had previously confined strategy to a straightjacket. Except for somewhat better maps, roads, and the Chapp'e telegraph, neither Napoleon's conquests nor his subsequent defeat can be explained in terms of technological factors.[12] The result of the Napoleonic RMA was not just the ability to conquer a neighbor, but to seize a continent -- or in modern terms, the means to wage a theater-wide campaign.[13]

**2. The Rifle, Railroad, and Telegraph RMA**

The next revolution took place in the second half of the nineteenth century and was highlighted by the American Civil and Franco-Prussian Wars. New types of weapons, such as breech loading rifles and rifled cannons (the latter made of steel rather than bronze), and new means of transport, the railways, were being introduced simultaneously, thus making necessary a complete reappraisal of the traditional methods of war. Even the

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[11] Martin Van Creveld, *Command in War*, (Cambridge, Mass.: Havard University Press, 1985), p. 60.
[12] Martin Van Creveld, *Technology and War*, (New York: The Free Press, 1989), p. 167.
[13] Jeffrey R. Cooper, *Another View of the Revolution in Military Affairs*, (Carlisle Baracks, Pennsylvania: U.S. Army War College, 1994), p. 14.

stepchild of war -- communications technology was finally showing signs of progress. The telegraph now presented armies with a new and some ways unprecedentedly effective means for transmitting information. However, the relation of science and industry to the soldier was in its infancy as the industrial revolution took place. The same inventors that were developing new products for the home and workplace were also developing new instruments for war. Despite widespread use of the new technlogies, none of the developments had reached a state of maturity in which the basic rules governing their employment, and its effects, were no longer the subject of debate.[14]

The fixed nature of both railroads and the telegraph had significant ripple effects. The railroad was less flexible than columns of men and horses, which could always be made to go another mile or find their way around. Coordinating men, weapons, supplies, and trains, as well as maximizing each railway line's capacity and preventing congestion demanded a type of painstaking staff work. No longer was it possible for a single or select number of generals to organize the movement of a large army. During this time, the first true general staffs, such as with Prussian General H. von Moltke, began to emerge.[15]

Like the railroad, the telegraph also necessitated the formation of new specialized corps. Persons were needed to survey the route, install, operate, and maintain the new equipment. Because access to fixed communication points and the amount of information that could be passed in a given time was limited (usually eight to ten words a minute),[16]

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[14] Martin Van Creveld, *Command in War*, p. 104.
[15] Ibid, p. 106.
[16] Ibid, p. 108.

doctrine was needed to regulate its use. The telegraph also had an influence on command style. Because the construction of new lines took time and could not keep up with the front or were easily destroyed if placed too close to the front, the temptation of the commander was to stay further to the rear. Additionally, communication tended to flow up the chain of command rather than down to the soldiers in the field.

### 3. The Mass Production RMA

World War I incorporated mass production technologies to equip multi-million men armies, to increase mechanization for support to logistics, and to employ factory products like the machine gun and barbed wire.[17] A number of new and radical weapons such as the airplane, submarine, tank, and poison gas appeared on the battlefield in significant numbers despite the fact that organizational structures or doctrines for their use had not been fully developed. Coordination of previously unrealized numbers of soldiers and supplies became possible due wireless radios, telephones, trucks and automobiles, and improved railroads.

Scientists began to produce significant effects on the battlefield during this war. This was a natural extension of the increasing scope of warfare that began with Napoleon. As entire nations were mobilized for warfare, the scientist and industrialist were naturally called on to contribute. Each side enlisted technical experts to solve specific battlefield problems. The British effort to combat the German U-boats illustrates how vital the role of the scientist had become. On September 23, 1914 a single German submarine sank three

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[17] Jeffrey R. Cooper, *Another View of the Revolution in Military Affairs*, p. 14.

British armored cruisers resulting in the deaths of almost 1,500 sailors. Initial efforts by the Royal Navy to locate the U-boats included attempts to train sea gulls to perch on periscopes to make them more visible and the use of sea lions to detect intruders.[18] By 1916 British scientists, physicists, chemists, and mathematicians developed two devices that were much more successful -- the hydrophone and depth bomb.[19] These new weapons, combined with the rediscovered doctrine of convoying merchant ships through high submarine threat areas, resulted in the failure of German efforts to blockade Britain.

**4. The Inter-war RMA**

The revolution that took place between the two World Wars is the one that has received the most attention by today's scholars and military officials. There are two principal reasons for this attention. First, there are a number of similarities that can be drawn between the strategic situation of the United States then and now. During this time frame, military institutions had to come to grips with enormous technological and doctrinal innovation during a time of minimal funding and relatively low popular support for military affairs. Second, the large number of countries involved in the Second World War provide numerous examples of which innovative strategies were successful, and which failed. Thus, great opportunities for comparison exists. Finally, the innovations made during the 1920s and 1930s were significant and not just on the margins. For example, the U.S. and Japanese navies changed the equation of war at sea with their creation of naval air power

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[18] Robert L. O'Connell, *Sacred Vessels* (New York: Oxford University Press, 1991), p. 162

[19] Bernard and Fawn M. Brodie, *From Crossbow to H-Bomb* (Bloomington, Indiana: Indiana University Press, 1973), p. 184.

based on carriers that accompanied their fleets into battle. Similarly, the Germans developed an the Blitzkrieg armored force, based on a combined-arms concept, that overthrew the entire balance of power in Europe by its breakthrough on the banks of the Meuse and the exploitation of that success to the English channel. In the air war, Air Marshall Sir Hugh Dowding set the technological specifications for the Hurricane and Spitfire, supported the initial research into the possible use of radio waves to detect aircraft, and then created an air defense network based on these innovations.[20]

### 5. The Nuclear RMA

The next revolution began with the closing moves of the Second World War -- the nuclear revolution. During this time, the destructive power of nuclear weapons, the advancements in rockets, and the rapid development of electronics and computer technology making possible the guidance systems for ballistic missiles were all introduced and perfected.[21] Additionally, huge organizations were created to support these new weapons. Intelligence agencies, with revolutionary capabilities in their own right, were created to ascertain and monitor the status of enemy forces. Doctrines for the use of nuclear weapons also were created, debated, and changed as the weapon's capability improved and new intelligence was gathered.

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[20] Allan R. Millett and Williamson Murray, *Innovation in the Interwar Period*, (Washington, D.C.: Office of Net Assessment, 1994), p. iii-iv.

[21] Harriet Fast Scott and William F. Scott, *The Soviet Art of War: Doctrine, Strategy, and Tactics*, (Boulder, Colorado: Westview Press, 1982), p. 123.

## C. ORIGINS OF THE RMA CONCEPT

The concept and study of military innovation and fundamental changes in the nature of warfare is not a new or recent phenomenon -- although the vast amount of books, articles, and Department of Defense attention it has received over the past five years could lead one to believe otherwise. All of the relatively recent theories and comprehension of RMA concepts can be traced back to one of two sources. The first are classical military writings that have been authored since the time of Sun Tzu.[22] Although the term "Revolution in Military Affairs" or the specific identification of changes in technology, doctrine, and organization as "revolutionary" does not appear until the essays of Michael Roberts in the early 1960s,[23] the concepts are central to a multitude of works. The other origin is the writings of Karl Marx and his concepts of dialectical materialism. These writings and concepts provided the foundation for Soviet efforts to describe the changes in warfare following the development of intercontinental ballistic missiles that carried nuclear warheads -- what they called a "Revolution in Military Affairs." Interest by the United States military was negligible until essays and articles published in the late 1970s by the Chief of the Soviet General Staff, Marshall Nikolay Ogarkov, postulated that a new revolution was in its infancy. Since that time, a myriad of scholars and officials

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[22] Other classical military writings would include Niccolo Machiavelli, *The Art of War*, (New York: Da Capo, 1990); Carl Von Clausewitz, *On War*, (Princeton, N. J.: Princeton University Press, 1976); and Alfred Thayer Mahan, *The Influence of Sea Power upon the History, 1660-1783*, 21st ed. (Boston: Little Brown and Company, 1917);

[23] Michael Roberts paper was originally presented as a lecture before the Queen's University of Belfast on 21 January, 1955. A revised copy has been printed as "The Military Revolution, 1560-1660," in *Essays in Swedish History* (London: The Camelot Press Ltd., 1967), p. 195-225. A separate essay in the cited work titled "Gustav Adolf and the Art of War" also discusses the revolutionary aspects of war.

from the United States have provided additional thoughts on the concept. An examination of the two roots and current thought follows.

**1. Classical Roots**

As previously stated, pre-1960 accounts of changes in military technology, doctrine, and organization do not specifically label the consequences as "a revolution in military affairs." However, the realization that these three items make a difference did not arise within the last 40 years. The implications of new technologies, doctrine, and organization were well understood by ancient warriors. The following examples will illustrate this point:

> At the outbreak of the Peloponnesian War, light-armed troops were held in disdain. In the mountains of Aetolia, however, Athenian forces under Demosthenes were completely defeated by agile light-armed archers, who refused to come to close quarters. Before five years of this war had elapsed, it was perfectly clear that slingers, archers, and especially peltasts were necessary complements of an efficient army.[24]

> Before Philip [of Macedonia's] time no army, not even the Spartan, was kept constantly under arms. Although there had been before his day professional soldiers . . . he was the first leader to institute a professional standing army imbued with a national spirit and instantly and permanently operative. . . . [Philip's son] Alexander the Great inherited his father's organizing ability as well as an organized army. With his improvements and additions, Greek military efficiency had reached its acme.[25]

Treatises and discourses on warfare continued through the 19th and 20th centuries. Military thinkers of the 19th century such as Clausewitz and Jomini studied and wrote

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[24] Eugene S. McCartney, *Warfare by Land and Sea*, (New York: Cooper Square Publishers, Inc., 1963), p. 33-34.

[25] Ibid, p. 37.

extensively on the innovations and revolutionary implications of Napoleon's "lev'ee-en-masse". In 1875 Bronsart von Schellendorff wrote "Generalstabsdienst," which was a technical treatise on the organization and procedures of the Prussian model for a general staff. This treatise was published in England, France, and the United States during the next 25 years.[26] The impact of the ideas in this treatise are seen by the nations of Europe adopting the Prussian General Staff model by the turn of the century. If the model was not adopted, it had to be accounted for because it was likely being used by a potential enemy. Following World War II, a multitude of descriptions and studies of the innovations that took place before and during the war were published. The British air defense network, the United States and Japanese successful development of carrier aviation, and the U.S. Marine Corps' creation of an amphibious assault mission are but a few examples of popular subjects.

In the 1950s, Michael Roberts, a professor of Modern History at The Queen's University in Belfast, lectured and wrote on the effect changes in weapons technology from 1560 till 1660 had on military organizations, how militaries fought, and the structure of society as a whole.[27] This, in and of itself, is relatively unimportant. As chronicled in the previous paragraphs, similar works had long existed. What was new and important was his use of the term "military revolution" to describe the net effect innovations in military technology, organizational structure, and doctrine had on how wars were fought.

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[26] Van Creveld, *Command and War*, p. 149.
[27] Michael Roberts, "*The Military Revolution, 1560-1660.*"

## 2. Soviet RMA Concepts

When analyzing the development of the Soviet concept of military affairs, the Marxist-Leninist laws of dialectic materialism must be a primary consideration. Dialectical materialism is a general theory and method of philosophy developed by Plato and Aristotle and refined by Immanuel Kant and G. W. F. Hegel, and expounded by Karl Marx to explain the process of social evolution.[28] Because the Soviet military was part of society, they too believed in these theories of change. As observed by Lawrence Fink of The National Institute for Public Policy, by extrapolating past and current developments in military affairs within this Marxist context, the Soviet military community attempted to predict the future course of both military strategy and technology. For the Soviet military leadership, these prognoses have not been viewed as purely academic exercises. Rather, they are regarded as serious and necessary endeavors, the proper use of which could facilitate the Soviet military's ability to develop new weapons and corresponding strategies for their use with greater expediency.[29] Writing in 1981 for the Communist Party journal *Kommunist*, chief of the General Staff Marshal Nikolay Ogarkov wrote of dialectical materialism:

> The application of its laws in the process of obtaining scientific-technical knowledge, the examination of all aspects of war and their interconnections and interrelationships, makes it possible concretely to reveal and expose contradictions, the forms of the struggle of opposites, the transition from quantitative into qualitative changes, the mutual relationship of the old and the new, and even

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[28] Barbara P. McCrea, Jack C. Plano, and George Klein, *The Soviet and East European Political Dictionary*, (Santa Barbara, California: ABC-Clio, Inc., 1984), p. 60-61.

[29] Lawrence R. Fink, "The Soviet View of War and Military-Technical Progress: Implications for ICBMs," *Comparative Strategy*, Vol. 8, No. 3, (1989), p. 317.

> more correctly to approach exposing the specific laws of war and military affairs.[30]

As Marshal Ogarkov indicated, the most general laws of dialectic materialism are the transformation of quantitative to qualitative changes, the unity and struggle of opposites, and the law of negation of the negation. These laws express the universal forms of development of the material world and cognition of it.[31]

The law of the unity and struggle of opposites is based on the fact that the development of the objective world and of cognition are carried out through the bifurcation of an entity into mutually exclusive opposing moments, aspects, and tendencies; their interrelationship, the "struggle" and resolution of contradictions, on the one hand characterizes a given system as something integral an qualitatively determined, and on the other hand constitutes an internal impulse for the system's change, development, and transformation into a new quality.[32] In military terms, the appearance of new means of attack has always led to the creation of corresponding themes for counteraction. In the final account, this has led to finding new means for waging battles and combats, and conduct of operations. Thus, with the fast development of tanks, aviation, and submarines, anti-tank, anti-aircraft, and anti-submarine weapons and corresponding defense methods were developed. [33]

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[30] Nikolay Ogarkov, "Na Strazhe Mirnogo Truda," (On Guard for Peaceful Work), *Kommunist,* No. 10, (1981), p. 116.

[31] *The Great Soviet Encyclopedia*, 3d., Vol. 8 (Moscow: Sovetskaia Entsiklopediia Publishing House, 1970). Translated by MacMillan, Inc., 1975, p. 190.

[32] Ibid, p. 190.

[33] Nikolay V. Ogarkov, "Military Science and the Defense of the Socialist Fatherland," *Kommunist,* No. 7, (May 1978), p. 110-121.

The law of the reciprocal transformation of quantitative into qualitative changes reveals the most general mechanism of development: a change in the quality of an object occurs when the accumulation of quantitative changes reaches a certain limit, and a leap -- that is, the replacement of one quality by another -- occurs.[34] According to Soviet theories, quantitative changes in the firepower of weaponry occurred over several hundred years, as the musket was replaced by the breechloader, which developed into automatic weapons, of many types. But these, and even the V-1 and V-2 rockets of World War II, were a continuation of the revolution that began with gunpowder. When there are sufficient quantitative changes, a qualitative jump occurs -- a revolution in military affairs.[35]

The law of negation of the negation characterizes the direction of development. Its basic content is the unity of forward movement, progress, and continuity in development and the emergence of a new and relative recurrence of certain previously existing elements.[36] Thus, when a revolution occurs the old does not disappear all at once; its usable parts remain. However, the only "old" that continues to exist is that which finds a useful place in the environment created by the new. For example, in the international environment created by the presence of nuclear weaponry, nonnuclear or conventional military forces still have a place.[37]

The specific term *Revolution in Military Affairs* emerged out of the Soviet's effort to develop a doctrine for nuclear weapons following Joseph Stalin's death in 1953. Before

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[34] *The Great Soviet Encyclopedia*, p. 190.
[35] Scott and Scott, *The Soviet Art of War*, p. 123.
[36] *The Great Soviet Encyclopedia*, p. 190.
[37] Scott and Scott, The Soviet Art of War, p. 123-124.

his death, Stalin dominated Soviet military thinking. If he permitted discussion of the possible role of nuclear weapons in warfare it has been kept a tightly held secret in the Kremlin's archives.[38] At the Twentieth Party Congress in 1956, Nikita Krushchev denounced Stalin and called for a new examination of questions of military science.[39] Not surprisingly, when discussion of a doctrine was permitted, works by Western authors were read by Soviet strategistc. When the first Soviet books and articles on nuclear warfare appeared, they resembled in many respects works published in the United States five to ten years previously.[40]

Four years later, speaking before the Fourth Session of the Supreme Soviet, Nikita Krushchev outlined a new military doctrine. Soviet military doctrine would now emphasize the role of nuclear weapons and the Strategic Rocket Forces would become the pre-eminent branch of the military. It is interesting to note that true to the Marxist dialectic, the Strategic Rocket Forces preceded the deployment of the first four soviet Intercontinental Ballistic Missiles (ICBMs) by several years.[41] It was not enough that the new military doctrine be understood by all members of the Soviet Armed Forces; the implications of the new doctrine must be part of the ideological conditioning of each individual. In the Soviet Union, the Party leaders traditionally used slogans to emphasize to the "masses" changes in directions that have been made by the Party of guidelines for personal conduct. To make

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[38] Ibid, p. 124.
[39] Scott and Scott, *The Armed Forces of the Soviet Union*, p. 41.
[40] Scott and Scott, *The Soviet Art of War*, p. 125.
[41] Robert P. Berman and John C. Baker, *Soviet Strategic Forces: Requirements and Responses*, (Washington, D.C.: The Brookings Institution, 1982), p. 104.

the Soviet Armed Forces, and the population as a whole, fully aware that a major transformation had taken place both in the conduct of war and in its consequences, a slogan was needed that would signify the change. To be effective a slogan must have emotional appeal. The purpose of the Armed Forces, as Soviet ideologists constantly affirm, is to protect the "gains of the revolution." In this context, "revolution" is synonymous with the revolution of the proletariat. In the Soviet Union, "revolution" is good and associated with the Party, which itself came to power through the "glorious revolution."[42] Thus, "The Revolution in Military Affairs" was selected as the slogan that was to explain the changes in warfare and in the Soviet Armed Forces that had resulted from the breakthrough in nuclear weapons and ballistic missiles.[43]

Articles by high ranking officials of the Soviet military to explain the new revolution began to appear in professional military publications such as *Red Star* and *Communist of the Armed Forces*. In an article that originally appeared in the February 15, 1963 issue of *Red Star,* General Lieutenant of Aviation N. A. Sbitov described the result of the new nuclear capabilities:

> The revolution in military affairs is an accomplished fact. It led to basic quantitative and qualitative changes in the military-technological base of the Armed Forces and in its structure. It marked a revolution in the methods of waging war, a revolution in the theory of military art and actual combat training of the troops. [44]

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[42] Scott and Scott, *The Armed Forces of the Soviet Union*, p. 47.

[43] William R. Kintner and Harriet Fast Scott, *The Nuclear Revolution in Soviet Military Affairs*, (Norman, Oklahoma: The University of Oklahoma Press, 1968), p. 4.

[44] N. A. Sbitiov, "The Revolution in Military Affairs and its Results," in *Problems of the Revolution in Military affairs*, ed. Colonel P. M. Derevyanko (Moscow: Military Publishing House, 1965) in Kintner and Scott, *The Nuclear Revolution in Soviet Military Affairs*, p. 27.

Soviet Minister of Defense, Rodion Ya. Malinovsky, expressed similar sentiments regarding the nuclear revolution in an article titled, *The Revolution in Military Affairs and the Task of the Military Press*. However, in addition to describing the current nuclear revolution (the first quote), he asserted additional revolutions were possible (the second quote):

> Fundamental qualitative changes have taken place in all the basic areas of military activity: armaments, organization, combat methods, and methods of training and educating personnel. This has been caused, first of all, by the wide introduction of the nuclear rocket weapon and new equipment assuring its use.[45]

> But new weapons are both being perfected and being substituted by even newer. One cannot exclude the possibility of the appearance of a weapon that is new in principle.[46]

In 1977, Marshall of the Soviet Union Nikolai Ogarkov was selected as Chief of the General Staff of the Armed Forces and USSR First Deputy Minister of Defense. Shortly after this promotion, evidence began to surface that Soviet military doctrine was beginning to change to one with less emphasis on nuclear weapons and more toward advanced conventional munitions. Evidence of this change includes Leonid Brezhnev's 1977 Tula address in which he stated that the USSR was "not striving for superiority with the aim of delivering a first strike. Acceptance of the American concept of Mutual Assured

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[45] Rodion Malinovskiy, "The Revolution in Military Affairs and the Task of the Military Press," in *Problems of the Revolution in Military Affairs*, ed. Colonel P. M. Derevyanko (Moscow: Military Publishing House, 1965) in Kintner and Scott, *The Nuclear Revolution in Soviet Military Affairs*, p. 19.
[46] Ibid, p. 20.

Destruction (MAD), or assured unacceptable retaliation, followed during the next few years. Coincidentally, Ogarkov began to postulate that the United States was developing the capability to conduct a protracted military action using only conventional weapons. The following quotes from Ogarkov illustrate his vision of future warfare and the next RMA. The first quote is from 1982. The second is from 1985.

> A profound, and in the full sense revolutionary turn is taking place in military affairs in our time in connection with the development of nuclear weapons, rapid advances in electronics, development of weapons based on new principles of physics, as well as in connection with extensive qualitative improvements of conventional weapons[47]

> The fourth revolution, one based on advances in sensors and computing systems that would give conventional weapons an effectiveness equivalent to nuclear weapons.[48]

### 3. U.S. RMA Concepts

During the 1960s and early 1970s analysts and strategists in the U.S. and Western governments did not pickup on the all encompassing nature of the Soviet term "revolution in military affairs". There are several reasons for this: First, because the term RMA was initially used to describe how nuclear weapons had changed warfare, the term became almost synonymous with nuclear war. Second, it was easy for Western analysts to see nuclear weapons as revolutionary and that the nature of warfare had completely changed -- but not in the sense of the Marxist dialectic or as a general principle for analyzing warfare.

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[47] Nikolay V. Ogarkov, *Vsegda v gotovnosti k zaschite otechestva* (Always Ready to Defend the Fatherland) (Moscow: Voenizdat, 1982), p. 31.
[48] Nikolay V. Ogarkov, *Istoriya uchit bditelnosti* (History Teaches Vigilance) (Moscow: Voenzidat, 1985).

Third, because many of the initial Soviet books and documents concerning nuclear warfare borrowed from works previously published by Western authors, it was relatively easy to dismiss the concept as the Soviet spin on previous analysis and conclusions. Lastly, most Western scholars thought that the Cuban missile confrontation in 1962 and Khrushchev's ouster in 1964 had made Soviet military theoretical writings, such as *Military Strategy*, obsolete. Very little attention was given to Soviet military thought until the mid-1970s.[49]

During the late 1970s and early 1980s, defense analysts in the United States began to appreciate the concepts of an emerging RMA that were being discussed by Soviet officials. Support for the concepts was strongest in the Pentagon's think-tank -- the Office of Net Assessment (ONA). This interest was heightened because these concepts correlated to the doctrine and precision guided munitions (PGMs) that were beginning to emerge from within the U.S. military. On 25 March, 1981, the U.S. Army's Training and Doctrine Command (TRADOC) issued a preliminary statement of the future-oriented battlefield titled, *The AirLand Battle and Corps 86, TRADOC pamphlet 525-5.*[50] Approximately one year later, the basis for doctrinal changes in how the U.S. military would fight was released. It emphasized close air and land coordination, deep strikes to prevent first, second, and subsequent echelons from reaching the scene of the battle, and -- most significant -- the use of new technologies to hit targets previously assigned to nuclear weapons. In doing so, it [allegedly] reduced the chances of nuclear confrontation.[51]

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[49] Scott and Scott, *The Soviet Art of War*, p. 295.
[50] *The Airland Battle and Corps 86: TRADOC Pamphlet 525-5.* (Fort Monroe, VA: U.S. Army Operational Concepts, 1981).
[51] Toffler and Toffler, p. 61.

During the mid-1980s until after Desert Storm the concept continued to generate only mild interest throughout most of the defense community. The Soviets were still the unquestioned enemy. Relatively minor engagements in Grenada, Lebanon, Libya, Iran, and Panama provided only glimpses of the what the new technologies were capable of. In fact, arguements were made against using some of the new weapons in third world scenarios. For example, concerns existed regarding the potential for proliferation of the highly specialized guidance systems used in Tomahawk cruise missiles.[52]

Following the U.S. led coalition's dramatic victory over Iraq, interest in the RMA concept began to grow exponentially. Dramatic examples of precision strike weapons and warfighting capabilities were televised almost instantly around the world. Almost no place within the borders of Iraq was immune. A few precision guided munitions time and time again destroyed buildings that previously would have required an entire squadron of aircraft. The Iraqi Army of several hundred thousand soldiers was defeated in a matter of weeks with minimal losses. Surely this represented a revolutionary change in warfare from World War II. Secretary of Defense, William Perry, remarked about the excitement of change brought on by the Gulf War, "Where once technology had to be pushed at the services, now they eagerly seek it." [53]

The already growing interest in the RMA concept was fueled by the collapse of the Soviet Union. No longer was the primary enemy and its capabilities clearly identifiable and

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[52] Richard K. Betts, ed., *Cruise Missiles: Technology, Strategy, Politics*, (Washington, D. C.: The Brookings Institution, 1981), p. 219.
[53] "The Information Advantage," *The Economist* (June 10, 1995), p. 9.

well understood. A strong desire for historical guidance existed on how to do long-range strategic planning when no real enemy appeared to exist. Questions arose such as, "What capabilities would be needed in the future," and "What threats are likely to emerge?" Additionally, the military began to seek answers on how to further exploit the dramatic capabilities demonstrated during the Gulf War when the country was turning its attention inward and reducing resources allocated to the armed services. The concept of a Revolution in Military Affairs offered a framework to study change in military capabilities and explore the lessons of numerous historical examples.

## D. THE FUTURE RMA

Since being fully adopted by Western analysts, the concept of a RMA has lost most, if not all, of its Marxist connotations. In the United States, RMAs are not associated with the teachings of Marx and dialectic materialism. From a historical standpoint, the concept simply describes fundamental changes in technology, doctrine, or organization that render existing methods of warfare obsolete. Two themes predominate speculation of future RMAs. The first is integrating advanced conventional weapons with improved intelligence gathering and processing capabilities. The second is known as "information warfare."

### 1. Brilliant Conventional Weapons

The concept of RMA has taken on many futuristic connotations due to the extensive number of articles and books that have emerged since Desert Storm. Several of the visions put forth in these works have become somewhat synonymous with RMA:

> Future weapons will be able to strike enemy forces at great distances. In mid- or high-intensity combat, it may not always be necessary to physically occupy key terrain on the ground, vital airspace, or critical choke points at sea in order to control them. While wars will still be won only when soldiers occupy the enemy's territory, it may not be necessary in every case to 'close with' the enemy in order to destroy him.[54]
>
> Admiral David Jeremiah

> Our C3I (command, control, communications, and intelligence) loop from decision to action is expected to be compressed by orders of magnitude -- increasing the tempo of operations such that we are well within the command cycle of any adversary.[55]
>
> General Sullivan

> By 2005 we could have the technical capacity of sensing roughly 90% of everything of interest in a 200 by 200 mile area.[56]
>
> Admiral William Owens

> Space assets facilitate effective command and control and enhance the joint utilization of our land, sea, and air forces. . . . Interactive information sharing is key to modern battlefield success.[57]
>
> National Military Strategy (1995)

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[54] Admiral David Jeremiah, "What's Ahead for the Armed Forces," *Joint Forces Quarterly*, No. 1 (Summer 1994), p. 33-34.

[55] General Gordon R. Sullivan and Col. James M. Dubik, "War in the Information Age," *Military Review*, (April 1994), p. 47.

[56] Admiral William Owens, "Get Smart Weapons," *Navy News & Undersea Technology*, (3 October, 1994), p. 1.

[57] General John M. Shalikashvili, *National Military Strategy of the United States of America: 1995*, (Washington, D.C.: U.S. Government Printing Office, 1995), p. 14-15.

In addition, each branch of military service has issued its own vision of how it will fight in the future with the benefit of revolutionary changes. The Army has published "Force XXI" for the 21st century, the Navy offers "Forward . . . From the Sea," the Marines have their companion piece in "Operational Maneuver . . . From the Sea," and the Air Force has issued "Global Reach, Global Power."[58] Admiral Owens in the May 1995 issue of *Proceedings*, comments on the views of the individual services on future warfare. He states, "The visions they sketch are remarkably similar. Each points toward the capacity to use military force with greater precision, less risk, and more effectiveness."[59] He also observed that each relies on three areas of technology:[60]

- Intelligence, surveillance, and reconnaissance (ISR)
- Advanced command, control, communications, computers and intelligence (C4I)
- Precision-guided munitions (PGMs)

These are the basic "ingredients" of what the U.S. defense establishment envisions as the future RMA. However, the implications of combining intelligence (J2), communications (J6), and the warfighter (J3) have yet to be worked out.

**2. Information Warfare**

Information warfare (IW) is another possible area that RMA possibilities are postulated. A current definition of IW is:

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[58] Department of the Army, *Force XXI Operations: A Concept for the Evolution of Full-dimensional Operations for the Strategic Army of the Early Twenty-first Century*, (Fort Monroe, VA.: U. S. Army Training and Doctrine Command, 1994); Secretary of the Navy, *Forward From the Sea*, (Washington, D. C.: Department of the Navy, 1994); Office of the Chief of Staff, United States Air Force, *Global Reach, Global Power*, (Washington, D.C.: Headquarters, Department of the Air Force, 1991)

[59] Admiral William A. Owens, "The Emerging System of Systems," *Proceedings*, Vol. 121, No. 5, Issue 1,107 (May 1995), p. 36.

[60] Ibid, p. 36.

> Actions taken to achieve information superiority in support of national military strategy by affecting adversary information and information systems while leveraging and protecting our information and information systems.[61]

This definition covers the entire spectrum of how the political, economic, social and military structures of a given country receive and interpret data. The victim of IW may not even realize their data gathering systems, and ultimately their decisions, are being manipulated. The enemy could potentially be anyone from a terrorist group or subnational organization to a super-power.

The military component of information warfare is command and control warfare (C2W). Five components make up the foundation of an effective C2W strategy:[62]

> **1) Operational security**
>
> Operational Security (OPSEC) is the process of denying adversaries information about friendly capabilities and intentions by identifying, controlling, and protecting indicators associated with planning and conducting military operations. The goal of OPSEC is improved effectiveness in military operations.[63]

> **2) Military deception**
>
> Military Deception (MILDEC) are those actions executed to mislead foreign decision-makers causing them to derive and accept desired appreciations of military capabilities, intentions, operations, or other activities that evoke foreign actions that contribute to the originator's objectives.[64]

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[61] Vicente Garcia et. al., *Information Warfare: A Revolution in Modern Warfighting Concepts,* (Monterey, California: Naval Postgraduate School, 1995), p.4-5.
[62] Ibid., p. 6-9.
[63] The Chairman, Joint Chiefs of Staff, *Joint Pub 3-54: Joint Doctrine for Operations Security,* (Washington, D.C.: National Defense University Press, 27 August 1991)
[64] The Chairman, Joint Chiefs of Staff, "Military Deception," *MOP 116* (5th revision), 24 March 1987.

**3) Psychological operations**

Psychological Operations (PSYOPS) are planned operations involving the use of mass media techniques and/or actions to convey selected information indicators to foreign audiences to influence their attitudes, emotions, motives, objective reasoning, and ultimately the behavior of the foreign government, organizations, groups, and individuals.[65]

**4) Electronic warfare**

Electronic Warfare (EW) is any military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. The three major subdivisions within electronic warfare are electronic attack (EA), electronic protection (EP), and electronic warfare support (ES).[66] Electronic attack, formerly known as ECM, involves the use of electromagnetic or directed energy to attack personnel, facilities or equipment with the intent of degrading, neutralizing or destroying enemy combat capability. Electronic protection, formerly known as ECCM, involves actions taken to protect personnel, facilities and equipment from any affects of friendly or enemy employment of electronic warfare. Electronic warfare support, formerly known as ESM, involves actions taken to search for, intercept, identify and locate sources of intentional and unintentional radiated electromagnetic energy.

**5) Physical destruction**

Physical destruction is the permanent disabling or incapacitating of enemy C2-equipment or C2-systems such that the systems or equipment are no longer a threat to friendly forces. Careful coordination must be maintained with both PSYOPS and MILDEC to ensure that a target being manipulated is not destroyed.[67]

### 3. Conclusions

Both of these potential RMAs involve new and emerging concepts of warfare which will require new skills, command structures, and organizations. In conjunction with new capabilities, many questions regarding the nature of warfare will have to be answered.

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[65] The Chairman, Joint Chiefs of Staff, *Joint Pub 3-53: Joint Psychological Operations Doctrine*, (Washington, D.C.: National Defense University Press, February 1987).

[66] The Chairman, Joint Chiefs of Staff, "Electronic Warfare," *MOP 6*, 19 January 1990.

[67] The Chairman, Joint Chiefs of Staff, "Command and Control Warfare," *MOP 30*, 08 March 1993.

Such questions include the following: If these areas of warfare do develop, what are the implications during both peacetime and war? Will the tools for diplomatic signaling change? Can the influence on events currently exerted by military presence be accomplished from thousands of miles away or in a virtual world? Where will the battlefield be? How will victory be determined? All such questions must be satisfactorily answered before a RMA in either of these areas can emerge.

# III. THE INTELLIGENCE MISSION

Professor R. V. Jones, the principal scientific intelligence advisor to British Prime Minister Winston Churchill during World War II, listed ascertaining the development of new weapons and improvement of existing ones by other countries as the number one objective of the Scientific Intelligence Service.[1] The goal of the U.S. intelligence community regarding a potentially hostile revolution in military affairs should be identical, but with an expanded and more general mission of ascertaining the development of all new military capabilities -- not just the capabilities of weapons. In Sherman Kent's 1949 classic book on intelligence titled, *Strategic Intelligence*, he indicated that the intelligence of future capabilities, termed the speculative-evaluative form of intelligence, was vital to national security:

> Information to be acquired deals with the future and its possibilities and probabilities: how another country may shape its internal forces to service its foreign policy or strategy; how it may try to use these strengths against us, when, where, and with what effectiveness. [2]

An examination of the intelligence process, required attributes of good intelligence, and the critical mission of alerting the decision-maker to potential capabilities and actions by hostile countries -- commonly termed "Indications and Warning" intelligence -- will suggest a method for accomplishing Professor Jones' and Doctor Kent's objective.

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[1] R. V. Jones, *The Wizard War*, (New York: Coward, McCann & Geoghegan, Inc., 1978), p. 74.
[2] Sherman Kent, *Strategic Intelligence*, (Princeton, New Jersey: Princeton University Press, 1951), p. 7.

## A. TYPES OF INTELLIGENCE

### 1. Definition

The term "intelligence" has been defined by different authors in many different ways. Von Clausewitz, in *On War*, equated intelligence to information:

> By "*intelligence*" we mean every sort of information about the enemy and his country -- the basis, in short, of our plans and operations.[3]

The United States Navy goes one step further and differentiates between "finished" intelligence and "raw" intelligence. Additionally, the Navy's definition strongly implies that intelligence must come by way of a formal organization and process:

> *Intelligence* is the product resulting from the collection, exploitation, processing, integration, analysis, evaluation, and interpretation of available information concerning foreign countries or areas.[4]

*Joint Pub 2-0*, the U.S. military's Joint Doctrine for Intelligence Support to Operations, does not give a general definition of *intelligence*. Instead, it defines three subsets of intelligence: Strategic intelligence, Operational intelligence, and Tactical intelligence. Better definitions and descriptions of these terms are found in the doctrine for U.S. Navy which is titled, *Naval Doctrine Publication 2: Naval Intelligence*.

> **Strategic Intelligence** is required for the formation of policy and military plans at national and international levels. At the strategic level, intelligence is oriented toward national objectives and supports the formulation of policies and determination of priorities. Strategic intelligence focuses first on discerning the capabilities and intentions of potential adversaries as well as considering the strategic intentions of allies and other potential multinational partners. Strategic intelligence plays a central role in identifying an adversary's center of gravity. [5]

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[3] Carl Von Clauswitz, *On War*, 21st ed. (Princeton, N. J.: Princeton University Press, 1976)
[4] Chief of Naval Operations, *Naval Doctrine Publication 2: Naval Intelligence*, (Washington, D.C., Department of the Navy, 1994), p. 4.

> **Operational Intelligence** is required for planning operations within regional theaters or areas of operations. It concentrates on intelligence collection, identification, location, and analysis to support the operational level of warfare, which includes identifying an adversary's operational critical vulnerabilities. Further, it assists the commander in deciding how best to employ forces while minimizing risk.[6]

> **Tactical Intelligence** is intelligence required for planning and conducting tactical operations at the component or unit level. It focuses on a potential adversary's capabilities, his immediate intentions, and the environment. It is oriented more toward combat than long-range planning.[7]

As the three different subsets of intelligence imply, the value of an individual piece of intelligence depends on the purpose. For example, intelligence on the disposition of an enemy mechanized unit located on the other side of a ridge is a critical piece of information for the unit level tank commander. The same intelligence is only a small piece of the complete enemy force disposition that the theater commander must posses. For the President, who must focus on national objectives, the location of a single enemy unit is far too detailed to be useful in making strategic decisions. Evident from this example is that, in general, as the level of detail required by the consumer becomes more precise, the scope of intelligence gets broader. Tactical intelligence is needed when combat operations are close at hand or ongoing. Strategic intelligence is used to plan years and decades into the future. It is the most applicable level of intelligence to employ in examining the possibility of detecting a potentially hostile RMA.

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[5] Ibid., p. 6.
[6] Ibid., p. 6.
[7] Ibid., p. 6.

## B. THE INTELLIGENCE CYCLE

Although types of intelligence and ultimate consumer can be very different, the process of intelligence production does not vary. This process can be broken down into a series of interrelated activities termed the "intelligence cycle" or "intelligence process." [8] Figure 1 illustrates the process through which the commander levies intelligence requirements, information is collected and converted into intelligence, and intelligence is disseminated to users.

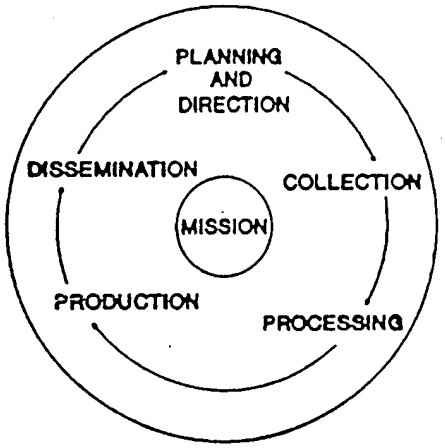


Figure 1. The Intelligence Cycle

[8] The "Intelligence cycle" is described in several publications with little variance. Those pulbications include: Jeffrey T. Richelson, *The U.S. Intelligence Community*, (New York: Ballinger Publishing Co., 1989), p. 3-4; Authur S. Hulnick, "The Intelligence Producer-Policy Consumer Linkage," *Studies in Intelligence*, Vol. 29, No. 4, (Winter 1985), p. 75-76.; Chief of Naval Operations, *Naval Docrine Publication 2: Naval Intelligence*, (Washington, D.C.: Naval Doctrine Command, 1994), p. 24-26; Chairman of the Joint Chiefs of Staff, *Joint Doctrine for Intelligence Support to Operations*, (Washington, D.C.: Office of the Chairman: The Joint Chiefs of Staff, 1993), p. II-3 - II-10.; Herbert E. Meyer, *Real World Intelligence*, (Friday Harbor, WA: Storm King Press, 1991), p. 33.

This cycle normally consists of five steps: planning and directing, collection, processing, production, and dissemination. This cycle greatly simplifies a dynamic and complex process, but it is useful to illustrate how the intelligence process works. Naturally, intelligence efforts do not always flow sequentially through the cycle. For example, a request for imagery generates planning and direction, but may not involve new collection if the request can be satisfied from archival imagery.

### 1. Direction and Planning

In the *Direction* phase, the commander must identify and prioritize his policy objectives. This must be done to ensure the information being collected is relevant to a particular problem. Sherman Kent addressed the problem of collecting relevant information in his 1951 book *Strategic Intelligence*, "Intelligence is not knowledge for knowledge's sake alone. . . intelligence is knowledge for the practical matter of taking action. Fulfillment of this function requires that the intelligence staff know a great deal about the issue which is under discussion . . . ."[9] If the intelligence staff is not providing relevant intelligence to the policy-maker, useful information needed to make crucial decisions will either be sought elsewhere or done without. Neither option optimizes the use of assets or increases the likelihood of successful policies. In short, intelligence must be relevant to the issues at hand.

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[9] Sherman Kent, *Strategic Intelligence*, p. 180.

A potential downfall exists with a close relationship between the policy-maker and intelligence staff. If the intelligence staff becomes too close to the policy-maker, it is possible that they will cease to objective. Once objectivity is lost, no one is capable of authoritatively telling the policy-maker that the current course is not producing the desired results. General William Donovan, who headed the Office of Strategic Services (OSS) during World War II, recognized this potential problem in a 1946 speech when he stated, "Intelligence must be independent of the people it serves so that the material it obtains will not be slanted or distorted by the views of the people directing operations." [10] The absolute necessity for intelligence to be both relevant and objective requires a delicate balancing act.

The second necessary element is the *Planning* stage. Because resources are limited and many different decision-makers have unique intelligence requirements, efforts must be made to optimize the available resources and answer the most critical questions. Identifying the critical questions or essential elements of information (EEIs) is not as easy as it may sound. In his book *Real World Intelligence*, Herbert Meyer recognizes this difficult problem:

> Figuring out the right things to know about -- which is to say the things that will directly help you reach a particular objective -- is one of the trickiest, least understood, and most underrated jobs in the world. What's required to this job is not so much an expertise in one or another specific subject or issue, but rather the ability to recognize what factors will influence that specific subject or issue.[11]

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[10] Major General William J. Donovan, *Vital Speches*, Vol. XII, No. 14, (1 May 1946), p. 248 in Arthur S. Hulnick, "The Intelligence Producer-Policy Consumer Linkage," *Studies in Intelligence*, Vol. 29, No. 4, (Winter 1985), p. 72.

[11] Hebert E. Meyer, *Real World Intelligence*, p. 33-34.

For example, if the specific objective is at least 72 hours warning of an Iraqi attack on Kuwait, one of the factors that could influence this goal is the readiness status of the Iraqi elite Republican Guards. A single EEI would be the status (in storage or lined up departing the compound) and location of assigned vehicles such as tanks and armored personnel carriers. After the EEIs are identified and prioritized, a particular collection asset can be tasked with obtaining the needed data. This is the meat of a collection plan. If an EEI can not be satisfied, the decision-maker must be notified so that additional measures can be taken to obtain the information or limit the consequences of this lack of knowledge. Planning does not end with the identification of how the information will be collected, it includes the identification of who is responsible for analyzing the received data and how the new intelligence will get to the consumer.

**2. Collection**

Jeffrey Richelson in *The U.S. Intelligence Community* defines collection as, "The purposeful acquisition of any information that might be desired by analysts, consumers, or operators."[12] The U.S. Navy outlines how an individual commander would use an intelligence organization to obtain a specific piece of information:

> Collection involves tasking organic (an asset or capability permanently assigned to the tasking command), attached, and supporting collection resources to gather information. The collection process determines what will be -- and what will not be -- available to support decision-making. Since few collection requirements can be met fully by organic assets alone, collection resources available at the theater and national level will normally be tasked as well. To do this effectively, the intelligence staff must know the capabilities and limitations of available collection resources, must understand the requirements validation process to obtain desired

[12] Jeffrey T. Richelson, *The U.S. Intelligence Community*, p. 2.

> collection approval, and must identify the collection resources that can contribute to fulfilling mission requirements.[13]

No matter the means of collecting data, the reason for its collection must never be forgotten. Data is needed to assist the policy-maker's in achieving specific objectives.

### 3. Processing

Processing is the conversion of collected information into a form suitable for producing usable intelligence, such as translating foreign languages, developing film from tactical reconnaissance aircraft, generating hard- or soft-copy images provided by electro-optical or infrared sensors, and converting raw electronic intelligence data into a standard message format suitable for automatic handling. Timeliness and accuracy are especially relevant during processing.

### 4. Production

This step is also known as "analysis." It is where a determination is made as to what the raw data means. All the skills of the analysts are used to fuse the bits of information into a clear, concise, and coherent picture of the situation. Meyer describes the process as follows:

> Transforming raw information into finished intelligence is itself a step-by-step process. You study the raw material, argue and debate what the material means with your intelligence colleagues, check and re-check the facts, resolve the inevitable inconsistencies in the data, question your original assumptions, assure that as many acknowledged experts as possible have been consulted, develop some tentative theses, and then test these theses time and again until you are confident that the theses are valid.[14]

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[13] Chief of Naval Operations, *Naval Doctrine Publication 2: Naval Intelligence*, p. 25.
[14] Hebert E. Meyer, *Real World Intelligence*, p. 41-42.

The U.S. Navy echoes the theme of incorporating numerous sources of data to ensure accurate and complete analysis:

> Intelligence production is the integration, analysis, evaluation, and interpretation of information from all available sources into tailored, usable intelligence. A key principle in production is the fusion of information from various sources to form a complete and accurate product. Fusion is essential for an effective intelligence production process that accurately reflects and supports the commander's prioritized essential elements of information.[15]

**5. Dissemination**

There is one word to describe an intelligence outfit that has identified what policy-makers need to know, collected all the raw information accurately and efficiently, done a careful and thorough job of analysis and evaluation, and in due course reached sensible, accurate, even brilliant conclusions, judgments, and projections. The word is: useless.[16] Unless the result of the previous four steps reaches the person responsible for making the decision, the effort was for naught. As noted in the U.S. military's Joint Doctrine for Intelligence Support to Operators, "Intelligence is disseminated in many forms, using a variety of means. Intelligence can take the form of verbal reports (face-to-face, and/or telephone, and video exchanges), documents (reports, studies, analyses, estimates, and assessments), graphic products (maps, overlays, charts, hardcopy imagery, videotape, motion picture film, 35mm slides, digital images, and view graphs), and information in

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[15] Chief of Naval Operations, *Naval Doctrine Publication 2: Naval Intelligence*, p. 26.
[16] Hebert E. Meyer, *Real World Intelligence*, p. 44.

intelligence data bases." [17] The primary factor in determining which form should be used is the desire of policy-maker. Obviously this factor will be different for different individuals. For example, some individuals prefer a verbal brief while others assimilate information better by reading a report and mulling over the implications. Intelligence is a support function -- information should be delivered to the customer when, where, and how it is needed.

The delivery of an intelligence product is not the end of the process. Again, the U.S. Navy recognizes this fact:

> Intelligence personnel must ensure that the product is actually used. This is a particular obligation of intelligence personnel who are members of operational staffs. They are in the best position to demonstrate the value of intelligence products to commanders and other staff members. Second, intelligence personnel must see to it that dissemination is refined by gathering feedback from the commander or other users to ensure that intelligence requirements have been satisfied and the finished intelligence products are usable. If not, the intelligence staff must take corrective measures to meet the needs of the commander.[18]

## C. ATTRIBUTES OF EFFECTIVE INTELLIGENCE

Effective intelligence has several mutually supportive attributes or qualities. In certain cases these qualities can appear as competing goals. For example, although both thoroughness and timeliness are attributes of any intelligence product, a goal of thoroughness for any one product could actually hinder timeliness. To be effective,

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[17] Chairman of The Joint Chiefs of Staff, *Joint Doctrine for Intelligence Support to Operations*, p. II-10.
[18] Chief of Naval Operations, *Naval Doctrine Publication 2: Naval Intelligence*, p. 26.

intelligence must strike a proper balance among the following -- sometimes conflicting -- attributes:[19]

**1. Timeliness**

Intelligence should be timely enough to support policy-making or decision-making, to enhance the prospect of mission accomplishment. Timeliness is most essential during the formulation of the commander's estimate and when handling highly perishable data normally called Indications and Warning (I & W) intelligence. To ensure that timeliness requirements are met, the commander must prioritize his information needs.

**2. Objectivity**

From the facts on hand, the intelligence analyst must be free to assess and report the situation without the influence of bias, distortion, or political constraint. Intelligence analysts should be meticulous in their efforts to discount preconceived notions and not allow these to influence, much less drive, the intelligence effort. The following quote from General Colin L. Powell, former Chairman Joint Chiefs of Staff, describes how intelligence should be presented: "Tell me what you know. . . tell me what you don't know . . . tell me what you think . . . always distinguish which is which."

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[19] These attributes can be found in a number of publications to include Serman Kent, *Strategic Intelligence*; Helene Boatner, "The Evaluation of Intelligence," *Studies in Intelligence*, Vol. 28, No. 2, (Summer 1984), p. 67.; Chairman of The Joint Chiefs of Staff, *Joint Doctrine for Intelligence Support to Operations*, p. IV-19 - IV-23.; The following description of attributes is from *Naval Doctrine Publication 2: Naval Intelligence*, p. 18-20.

### 3. Usability

A commander needs intelligence that is easy to understand and apply to operational decisions. Usability demand timeliness, relevance, and proper format or form. The speed and complexity both of modern threats and our own telecommunications systems place a premium on rapid intelligence dissemination. Commanders need this intelligence in time to react to threats and make better decisions.

### 4. Availability

To support the commander's planning and operations, intelligence should be available when and where needed. Availability requires foresight, and ability to predict, a clear understanding of objectives, and thorough intelligence training. In order to respond to rapidly emerging intelligence requirements, the intelligence officer should anticipate, collect, produce, and store information. We must be able to receive current, meaningful, appropriately classified intelligence to support changing operational requirements rapidly. Recognizing the need to protect sensitive intelligence sources and methods, we must guard against excessively restrictive classification of intelligence, which would deny it to the commander or operator who truly needs it. Many intelligence items can be "sanitized" by removing references to the highly-classified source of the data, and released at a lower classification.

5. Thoroughness

Thorough intelligence contributes directly to successful combat planning and execution. Proper identification and prioritization of the commander's essential elements of information help clarify the scope and detail of the intelligence required. The intelligence effort should give us the information we need -- nothing more, nothing less. Since the intelligence picture never will be complete, the commander should be aware of gaps in available information. By recognizing both the known and the unknown, a commander can apply appropriate judgment to reduce risk.

6. Accuracy

Intelligence should be factually correct and convey sound estimates of the adversary's intentions and capabilities. Accurate intelligence reduces uncertainty, thus increasing the commander's confidence in his understanding of the battlespace. comparison of information received from multiple sources improves the ability to verify information and reduces susceptibility to deception. The dissemination process must not reduce accuracy.

7. Relevance

Intelligence should pertain directly to the operations at hand and to the level of command for which it is intended. For example, the commanding officer of a destroyer conducting maritime interdiction operations would find it important to learn that a merchant ship with a history or arms smuggling is entering his area of responsibility. The National Command Authorities might find the same intelligence somewhat less relevant. If intelligence does not support the needs of the intended user, it has little value.

## D. INDICATIONS AND WARNING

### 1. The watch dog

The subset of intelligence designed to alert the intelligence analyst, and ultimately the policy-maker, of a possible surprise attack is called *indications and warning* (I & W) intelligence. The goal of this type of intelligence is to act as a perfect watch dog.[20] When potential danger is near or a situation that the policy-maker needs to know about is developing, an alert is sounded and the nature of the problem is identified. False alarms are held to absolute minimum to ensure that every alarm is treated with the attention it deserves. The United States Joint Doctrine for Intelligence Support to Operations defines Indications and Warning as follows:

> Those intelligence activities intended to detect and report time-sensitive intelligence on foreign developments that could involve a threat to the United States or allied military, political, or economic interest or to U.S. citizens abroad. Indications and Warning (I & W) includes forewarning of adversary actions or intentions; the imminence of nuclear or non-nuclear attack on the United States, its overseas forces, or terrorist attacks; and other similar events. The I & W process anticipates hostile operations and provides sufficient warning to enable U.S. or allied efforts to preempt, counter, or moderate such actions.[21]

### 2. Sufficient Warning

The term "sufficient warning" is necessarily ambiguous because it will be unique to a particular situation and the individual decision-maker. In a generic sense, "sufficient warning" means time enough for the decision-maker to gain an appreciation of the problem

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[20] R. V. Jones, "Intelligence and Command," *Studies in Intelligence*, Vol. 31, No. 3, (Fall 1987), p. 43-45.
[21] Chairman of the Joint Chiefs of Staff, *Joint Doctrine for Intelligence Support to Operations*, p. VI-6.

and have a full arsenal of options to counter it. The amount of actual time is dependent on the individual circumstances. The 6 October 1973 surprise attack on Israel by the Arabs and the 2 April 1982 invasion of the Falkland Islands by Argentina illustrate the consequences and differences in determining, "What is sufficient warning?"

On 5 October, Israeli intelligence officers still estimated a low probability of Egyptian attack and continued to ascribe Syrian concentrations to defensive plans.[22] By the morning of 6 October, only hours before hostilities commenced, intelligence indicated that an Arab attack was imminent. The 48 hours warning of an attack the military had counted on was not available and negligible time existed for concerted diplomatic initiatives to prevent the attack. As a result, the attack did take place and the Egyptians enjoyed unexpected early successes.

In the case of the Britain and the Falklands conflict, unlike Israel and the Yom Kippur War, two days warning prior to the invasion did not make any difference.[23] In fact, the first British naval units did not set sail for the South Atlantic until 72 hours *after* the invasion. The first British military response took place three weeks later when the Argentine submarine *Santa Fe* was attacked.

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[22] Michael I. Handel, *Perception, Deception, and Surprise: The Case of the Yom Kippur War*, Jerusalem Paper 19 (Hebrew University of Jerusalem, Leonard Davis Institute for International Relations), p.37, 58 in Richard K. Betts, *Surprise Attack*, (Washington, D. C.: The Brookings Institution, 1982), p. 76.

[23] The British and Argentine dispute over the Falkland and South Georgian Islands has been ongoing since 1820. However, tensions increased after the Argentine military junta, led by General Lopoldo Galtieri, came to power in December 1981. Negotiations through the Winter and early Spring provided no satisfactory solutions. By 31 March, the British government believed invasion was imminent within 48 hours -- which is when it actually happened. A full accounting of the Falklands crisis can be found in Lawrence Freedman and Virginia Gamba-Stonehouse, *Signals of War*, (Princeton, New Jersey: Princeton University Press, 1991) and *The Falklands Campaign: The Lessons*, which was presented to the British Parliament by the Secretary of State for Defence in December 1982 and printed by Her Majesty's Stationery Office in 1986.

The previously discussed cog of "dissemination" in the intelligence cycle and attributes of "timeliness" and "usability" are particularly relevant to providing sufficient warning. From a RMA perspective, the role of intelligence is to warn decision-makers if new weapons, organizational structures, or doctrines are being developed that could render current means of conducting warfare obsolete.

## E. THE WARNING PROCESS

### 1. The Warning Cycle

In 1983, John F. McCreary outlined a six-step cycle to describe the cognitive steps of the warning process.[24] This description also delineates responsibility for the performance of each step in the process.

| Intelligence | Decision-maker |
|---|---|
| 1. Recognition | 5. Evaluation |
| 2. Validation | 6. Action |
| 3. Definition | |
| 4. Communication | |

Recognition is the first step in the warning process and arguably the most difficult. Not only must an anomaly be noticed, but a determination that a change from previous observations is significant and represents a potential harm must be made.

[24] John F. McCreary, "Warning Cycles," *Studies in Intelligence*, Vol. 27, No. 3, (Fall 1983), p. 71-79.

Validation involves confirmation of the perceived anomaly to determine that not only what was noticed actually occurred, but that the interpretation of the data is correct. An incorrect interpretation of the data may or may not be a direct result of enemy intentions. Definition is the process of filling in the blanks about a danger, as to its nature, gravity, probability of occurrence, timing, and duration. It may not be possible to fill in all of the blanks but each blank must be considered.

Communication is the second most critical step in the process. If the problem is accurately defined but not relayed in a coherent and understandable manner to the decision-maker, the previous effort will be for naught.

The evaluation step shifts the focus of the process from the intelligence analyst to the decision-maker. Options are discussed as to what actions, if any, must be taken to solve the problem.

Actions authorized by the decision-maker are taken to address the problem. The intelligence analyst must now determine if the actions had the desired result, and if not -- why.

**2. Surprise and Intelligence**

From a military standpoint, the advantages gained by a surprise attack and the achievement of a revolution in military affairs are almost identical. As noted by Michael Handel in *War, Strategy, and Intelligence*, "A successful unanticipated attack will facilitate the destruction of a sizable portion of the enemy's forces at a lower cost to the

attacker . . . ."[25] The primary goal of every RMA is to increase combat effectiveness so that victory is more likely. However, unlike a surprise attack, a RMA does not require an ignorant or deceived enemy to be successful. It only requires the enemy to be unable to counter the new capabilities. An examination of the relationship between intelligence and strategic surprise will reveal lessons that can be transferred to the effort of recognizing anomalies and detecting a potentially hostile RMA.

**a. Information Quality**

Ephraim Kam, in his book *Surprise Attack,* identifies three factors that cause nations to be surprised.[26] The first is the quality of information and data available for judging and predicting enemy behavior. The usual lack of direct evidence pertaining to the enemy's intentions and the ambiguous nature of the available warning indicators are critical factors that make it very difficult to assess correctly both the intentions and capabilities of the opponent. These factors have been described as "the fog of peace." Although the collection of good information is absolutely essential, studies of military surprise reveal that evidence of enemy intentions and capabilities did exist prior to almost every attack.[27] The true challenge for the intelligence analyst is to separate the true signal from the background noise.

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[25] Michael I. Handel, *War, Strategy, and Intelligence*, (Totowa, N.J.: Frank Cass and Company Ltd., 1989), p. 229.
[26] Ephraim Kam, *Surprise Attack*, (Cambridge, Mass: Havard University Press, 1988), p. 7-37.
[27] This conclusion is supported by a large volumn of analysis to include Richard K. Betts, *Surprise Attack: Lessons for Defense Planning*, (Washington, D.C.: The Brookings Institution, 1982), p. 87-95.; Michael I. Handel, *War, Strategy, and Intelligence*, p. 229-274.; and Ephraim Kam, *Surprise Attack*, p. 7-37.

### b. Preconceived Perceptions

The second factor is the persistence of preconceived perceptions, even in the face of contradictory evidence. This is a significant human frailty that must be accounted for. Historical examples of this situation are numerous:

> The Joint Congressional Committee that investigated the Japanese attack on Pearl Harbor noted, "The consideration overshadowing all others in the minds of the Hawaiian commanders was the belief and the conviction that Pearl Harbor would not be attacked . . . ."[28]

> Robert E. Merriam on the December 1944 surprise German counter-offensive known as the Battle of the Bulge stated, "We were fooled because we were overconfident and certain that we had the Germans on the run. Intelligence officers, who were supposed to be born pessimists, were vying with each other for the honor of devastating the German war machine with words." [29]

> Before the 1973 war the Israelis felt that their army was so superior to the Arabs' that for the Arabs to launch an attack would be sheer madness. This was not only an intelligence assessment; it was shared by the political and military leadership, both the coalition and opposition parties, and in fact almost everyone.[30]

The ambiguous and often conflicting nature of the incoming data allows the assimilation of the new information into the old perception of reality. In addition, the Yom Kippur War example illustrates that even if the preconceived perception is essentially correct -- the Arabs would lose if they initiated a war with Israel -- adequate warning is not guaranteed.

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[28] LTC Robert R. Glass and LTC Phillip B. Davidson, *Intelligence is for Commanders*, (Harrisburg, PA.: Military Service Publishing Co., 1949), p. introdution in Robert W. Williams, "Commanders and Surprise," *Studies in Intelligence*, Vol. 26, No. 3, (Fall 1982) p. 11.

[29] Robert E. Merriam, *Dark December*, (Chicago: Davis Publishing Co., 1947), p. 225 in Robert W. Williams, "Commanders and Surprise," *Studies in Intelligence*, Vol. 26, No. 3, (Fall 1982), p. 11.

[30] Yaakov Talmon, "Heshbon Nefesh" (Introspection), *Haaretz*, 30 November 1973 as quoted by Ephraim Kam in *Surprise Attack*, p. 130.

Thus, if warning intelligence is to be effective, the right question must be asked. In the case of the Yom Kippur War, the most relevant question was, "Are the Arabs going to attack," not "Can the Arabs win if they attack."

**c. Interdependency**

The third factor, interdependency, links the first two factors in a vicious circle. The preconceived conceptions of the situation will dictate what intelligence will be sought and the incoming data will be matched against the current paradigm. This circle discourages any analysis that does not support the accepted reality. British defense estimates following World War I exhibited the pitfalls of this factor. Estimates were developed under the assumption that war would not occur for ten years -- the ten year rule. Any analytical conclusions to the contrary of this estimate would have to both correctly evaluate ambiguous incoming data and debunk the prevailing assumption.

**d. Devils Advocacy**

The most often recommended solution to the problem of preconceived perceptions is to require pluralism of opinion. During the 1970s, critics of intelligence estimates on the Vietnam War and Soviet nuclear strength were the strongest advocates of this solution. This solution has been termed *devils-advocacy*, *alternative analysis*, or the *A-team, B-team* approach.[31] Regardless of the term, analysts are tasked with developing alternative interpretations to a given set of data. Although this solution addresses the preconception

[31] W. D. Howells, "Intelligence in Crisis," *Studies in Intelligence*, Vol. 27. No. 3, (Fall 1983), p. 14.; Ephraim Kam, *Surprise Attack*, p. 224-225.

pit-falls, as both Richard Betts and Ephraim Kam point out, an entirely new set of problems arise:[32]

- Multiple assessments increases the odds the correct assessment will be delayed.
- The additional number of false alarms increases the likelihood of warnings being disregarded due to excessive "cries of wolf."
- Presenting alternative opinions still does not provide clues as to which is correct.
- At a time of decreasing resources, pluralism is not efficient.
- An analyst designated as the "devils advocate" is likely to be disregarded because it is their job to disagree. Disagreement for the sake of disagreeing does not help.
- Historical cases indicate that inadequacies in warning are rarely due to the absence of anyone ringing the alarm. Usually the alarm is disregarded.

## F. THE RECOGNITION PROBLEM

> This difficulty of accurate recognition constitutes one of the most serious sources of friction in war.[33]
>
> Carl Von Clausewitz

The first three steps of the warning cycle -- recognition, validation, and definition -- can be consolidated into the single problem of accurately identifying the problem. This is identical to the problem outlined in the previous section -- failure to correctly identify the problem. Combined, these three steps are the most critical and often most difficult link in the warning cycle -- especially when attempting to forecast a RMA.

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[32] Richard K. Betts, "Analysis, War, and Decision: Why Intelligence Failures are Inevitable," *World Politics*, Vol. 31, (October 1978), p. 76-78.; Ephraim Kam, *Surprise Attack*, p. 224-225.
[33] Carl Von Clausewitz, *On War*, p. 117.

### 1. Recognizing Anomalies

A psychological experiment conducted by J. S. Bruner and Leo Postman in 1949 and described thirteen years later in Thomas Kuhn's book, *The Structure of Scientific Revolutions*,[34] vividly demonstrates the difficulty and dangers of the recognition process. It also demonstrates that once an anomaly is recognized, the recognition of additional anomalies is significantly easier.

Subjects were exposed to a series of playing cards for brief and controlled period of time. Many of the cards were normal but a few were made anomalous, e.g., a red six of spades and a black four of hearts. After each exposure the subject was asked what he had seen. Even for the periods of shortest exposure, many subjects identified most of the cards, and after a small increase all the subjects identified them all. For the normal cards these identifications were almost always correct, but the anomalous cards were almost always identified, without apparent hesitation or puzzlement, as normal. The black four of hearts might, for example be identified as the four of either spades or hearts. Without any awareness of trouble, it was immediately fitted to one of the conceptual categories prepared by prior existence. With a further increase of exposure to the anomalous cards, subjects did begin to hesitate and to display awareness of anomaly. Further increase of exposure resulted in still more hesitation and confusion until finally, and sometimes quite suddenly,

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[34] The orginal study was performed by J. S. Bruner and Leo Postman and described in, "On the Perception of Incongruity: A Paradigm," *Journal of Personality*, XVIII (1949), p. 206-223. The study was used by Thomas S. Kuhn to illustrate the cognitive process of discovery in his book, *The Structure of Scientific Revolutions*, (Chicago: Universtiy of Chicago Press, 1970), p. 62-64.

most subjects would produce the correct identification without hesitation. Moreover, after doing this with two or three of the anomalous cards, they would have little further difficulty with the others.

Kuhn describes a number of other examples of recognition and discovery. In each case the pattern of recognition was the same: (1) awareness of the anomaly, (2) the gradual and simultaneous emergence of both observational and conceptual recognition, and (3) the change of paradigm categories and procedures.[35] The key is the first step -- awareness of the anomaly.

**2. The Need for Indicators**

A solution to both the problem of recognizing anomalies and accounting for preconceived perceptions and objectivity lies in Thomas Kuhn's example involving the playing cards. These experiments strongly suggest that the problem in identifying a new paradigm is cognitive in nature. One must be open to the possibility that new data may exist and not fit the accepted model. This is extremely difficult since the vast majority of data does fit the model and no prior knowledge regarding the nature of the anomaly is known. However, if one starts from the premise that anomalies may occur, even if their nature is unknown, significant steps toward earlier detection can be made. If the subject, prior to viewing the cards, considered that there may be anomalies in the cards, a list of possible changes could be assembled at a leisurely pace and without having to concentrate on the immediate task of identifying the cards. One possible change would be switching

[35] Ibid., p. 62-64.

the colors from black to red. Another would be substituting an eleven for the jack. There are certainly many other possibilities. More possible anomalies are likely to be considered than actually exist. When it comes time to view the cards, a quick comparison of the observed data to the list will increase the probability of detection.

Specific indicators and indicator lists for specific problems are not new to the military. For example, indicators of a Russian invasion of Europe would likely include:

- Dispersal and arming of aircraft
- Increased reconnaissance of the battle area.
- Cancellation of leave for soldiers.
- Activation of additional command and control networks.
- Movement of supplies such as fuel and ammunition to front line units.
- Political rhetoric indicating displeasure with the current status.

These indicators are specific actions, that can be observed, that the enemy must take to achieve a specific objective. During the initial stages of preparation for a surprise, only a few indicators are likely to be observed. However, as the time of action approaches, additional indicators will appear. As more and more of these indicators are observed, the less ambiguous future enemy actions become. A well conceived indicator list will articulate specific enemy actions that can be observed in time to provide sufficient warning.

Therefore, in the case of a RMA, what is needed is a number of indicators that a new means of conducting warfare is being developed. As shown in the previous chapter, a revolution in military capability will involve changes in technology, organization, and doctrine. Indication of changes in one of these three areas will begin to expose new military capabilities. As the new paradigm begins to emerge, additional tasking of the

intelligence system can be initiated to ascertain the true nature of the developing capabilities.

Any impressions that an indicator list is the perfect panacea are false. I & W intelligence and indicator lists does not give the analyst a perfect crystal ball. Not collecting relevant data can still occur. Different interpretations of data will continue. Policy-makers may still choose to ignore repeated warnings just as Stalin did prior to the Barbarossa invasion. Even the best I & W scheme can only tell you whether and to what extent a government is prepared or preparing to act. It cannot tell you why or what its intentions are, whether, for example, a government intends to attack or fears you may attack or is merely bluffing in tacit negotiation.[36] In short, a list will never take the place of highly skilled, energetic, and insightful analysts. However, it does provide a superior tool to assist the analyst.

[36] W. D. Howells, "Intelligence in Crisis," p. 10.

# IV. RECOGNIZING TECHNICAL REVOLUTIONS

## A. THE MILITARY TECHNICAL REVOLUTION

If the U.S. intelligence community is to detect and predict when another nation is about to achieve an RMA based on technology, it is necessary examine how technological innovation takes place. However, before examining the innovation process, the term "technical revolution" needs to defined and its effects examined.

### 1. Definition

To paraphrase the original definition of a revolution in military affairs, a military technical revolution (MTR) is "A fundamental advance in technology that renders existing methods of conducting warfare obsolete." As indicated in the previous chapter, the effects of a military technical revolution and technological surprise on the battlefield are virtually identical. Michael Handel's definition of technical surprise in his book *War, Strategy and Intelligence* offers some insight into a MTR or technological surprise:

> The unilateral advantage gained by the introduction of a new weapon (or the use of a known weapon in an innovative way) in war against an adversary who is either unaware of its existence or not ready with effective counter-measures, the development of which will take time.[1]

It must be noted that the term "weapon" includes any instrument that furthers the war effort and is not limited lethal devices or items present on the actual battlefield. Examples of non-lethal technologies that made a significant difference in the ability of armies to wage

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[1] Michael I. Handel, *War, Strategy, and Intelligence*, (Carlisle Barracks, Pennsylvania: Frank Cass and Company Ltd., 1989), p. 133.

war are the railroad, telegraph, and modern electronics. The Magic cipher used to decode Japanese secret codes during World War II was a technological surprise that did not appear on the field of combat but provided a decisive advantage throughout the war in the Pacific.

The phrase *the use of a known weapon in an innovative way* indicates more of a change in doctrine rather than advancement in technology. Also considered more a matter of doctrine than technology is the use of unanticipated quantities of a certain weapons such as airplanes or tanks. However, if a technology was developed that enabled the construction of airplanes or tanks at a significantly increased pace, or increased their survivability in combat, it would be considered part of a technical revolution. Because quantitative changes are more of a doctrinal nature, they will be discussed in the next chapter.

Handel's reference to counter-measures is an important acknowledgment that a MTR, or technological surprise, does not extend for an indefinite period of time. Just as effective counters to the hand-held crossbow were developed, and the telegraph was replaced by radios, a new technology will eventually be countered or negated. The key is that for an unknown and limited period of time, a decisive advantage will exist.

**2. Effects of an MTR**

A change in technology can have far reaching effects on warfare. This is true not just on the battlefield, but throughout all levels and phases of war. Van Creveld in his book, *Technology and War,* discusses the impact of technology:

> Military technology affects warfare like waves spreading from a stone thrown in a pond. The disturbance is strongest at the point of impact; the farther the ripples spread, the weaker and less noticeable they become. And the farther they go, the more likely they are to lose their identity by becoming intermixed with ripples thrown by other stones or reflected back from the pond's banks. Similarly, weapons and weapon systems make their power felt principally during combat, but war consists of much else besides. Apart from tactics, there are operations, strategy, logistics, intelligence, "C3" (command, control, and communications), and organization to mention but a few. Naturally all of these are affected by weapons, but are also strongly influenced by other kinds of hardware, as well as technology in its abstract sense. Thus we must begin by taking into account mundane things such as roads, vehicles, communications, timekeepers, and maps, and end by considering the most complex problems of technological management, innovation, and conceptualization. [2]

## B. STIMULUS FOR INNOVATION

The following quote from Sir Winston Churchill illustrates not only the problem of innovation but indirectly asks the question, "who stimulates innovation?"

> A hiatus exists between inventors who know what they could invent, if they only knew what was wanted, and the soldiers who know, or ought to know, what they want and would ask for it if they only knew how much science could do for them.[3]

### 1. Science-push

Two models have been developed to address the question of who drives military innovation -- the scientist or the soldier. The first model is that of 'Science-push.' This theory of innovation holds that pure curiosity-driven research by scientists looking only to

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[2] Martin Van Creveld, *Technology and War*, (New York: The Free Press, 1991), p. 2.
[3] Sir Winston Churchill, *The Great War, Vol 4* (London: The Home Library Edn., n.d.) Appendix 8, War Memorandum, 'Mechanical Power in the Offensive' (9 Novermber, 1916).

further human knowledge are the source of innovation. The case of the atomic bomb is an example of this model. During the 1920s and 1930s, scientist such as Einstein, Bohr, and Oppenheimer, conducted experiments to learn the nature of the atom. They were not in search of a bomb with destructive potential many times greater than previously imagined. Only after sufficient research did the possibility of an atomic bomb emerge. The feasibility of an atomic bomb was then communicated to the military, and eventually to President Roosevelt via a letter from Albert Einstein. This model is illustrated by the following outline:[4]

Curiosity-oriented research ----- Applied research ----- Experimental development ----- Innovation

**2. Demand-pull**

The alternate view of innovation is that of "demand-pull." According to this model, innovations are called forth by the stated needs of the military. In a more economic sense, innovation is the results of demands by market forces. Without a demand for the product, its invention would go unrealized. An example would be the vacuum tube computer which was initially developed during the early 1950s to more efficiently solve ballistic computations for the U.S. military. If the demand were not present, the research would not have been funded and the computer not invented. The following outline illustrates this model:[5]

Market demand ----- Applied research ----- Experimental development ----- Innovation

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[4] John Irvine and Ben R. Martin, *Foresight in Science*, (London: Frances Pinter Ltd., 1984), p. 15.
[5] Ibid., p. 16.

## C. LESSONS FROM STUDIES OF INNOVATION

### 1. Science and Demand are Factors

In John Irvine and Ben Martin's book *Foresight in Science, Picking the winners*, this science-push/demand-pull question is addressed by examining a number of studies that took place during the 1960s and early 1970s.[6] These studies were conducted with the goal of determining what government resources and actions would be most useful in promoting innovation. The lessons and conclusions of the various studies are equally useful from an intelligence standpoint, given that the goal is to determine what events or actions can be observed prior to the realization of technological innovations.

The studies did not reach any definitive conclusions on the demand-pull or science-push question. Everett Rogers and Floyd Shoemaker in their 1971 analysis of innovation concluded, ". . . research does not provide a clear answer to this question of whether awareness of a need or awareness of an innovation (that creates a need) comes first."[7]

However, a general trend in the relative strength of the models was noted. The predominance of critical discoveries, and the amount of effort leading up to an innovation, tends to shift from the realm of pure curiosity driven science to mission-oriented research

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[6] These studies include Battelle, *Interactions of Science and Technology in the Invention Process: Some Case Studies*, final report prepared for the National Science Foundation, Columbus, Ohio, Battelle Columbus Laboratories, 1973; IIT Research Institute, *Technology in Retrospect and Critical Events in Science (TRACES)*, Washington, D. C., National Science Foundation, 1968; C. W. Sherwin and R. S. Isensen, *First Interim Report on Project HINDSIGHT (Summary)*, Washington, D. C., Office of the Director of Defense Research Engineering, 1966.

[7] Everett Rogers and Floyd Shoemaker, *Communication of Innovation: A Cross-cultural Approach*, (New York: The Free Press, 1971), p. 106.

and development as the innovation nears completion. The diagram on the following page depicting the research origins of the video tape-recorder illustrates this point. Although not an innovation with significant military applications, the depiction is representative of the history of military innovations.

Note that nonmission-oriented research was more dominant during the period 25 - 50+ years before the actual innovation. However, beginning approximately 25 years before the video tape-recorder became a reality, mission-oriented research and developmental efforts started to become more prevalent.

**2. Curiosity-oriented Research is Unpredictable**

Breakthroughs resulting from curiosity-oriented research are difficult to predict and are more likely to occur a long time before the innovation or product emerges.[8] Additionally, the inventor is likely to have little concept of the products that will result because of the breakthrough.

**3. Confluence of Distinct Lines of Research**

Figure 2 also illustrates a significant lesson of innovation process that is useful in directing efforts to detect the development of a new technologies. The synthesis or confluence of previously distinct lines of research makes innovation possible. This lesson is borne out not only by the video tape-recorder. Airplanes combined the technologies of internal combustion engines and aerodynamic theory. Radars combined

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[8] IIT Research Institute, *Technology in Retrospect and Critical Events in Science (TRACES)*, (Washington, D.C.: National Science Foundation, 1968) in John Irvine and Ben R. Martin, *Foresight in Science: Picking the Winners*, (London: Francis Pinter, 1984), p. 20.

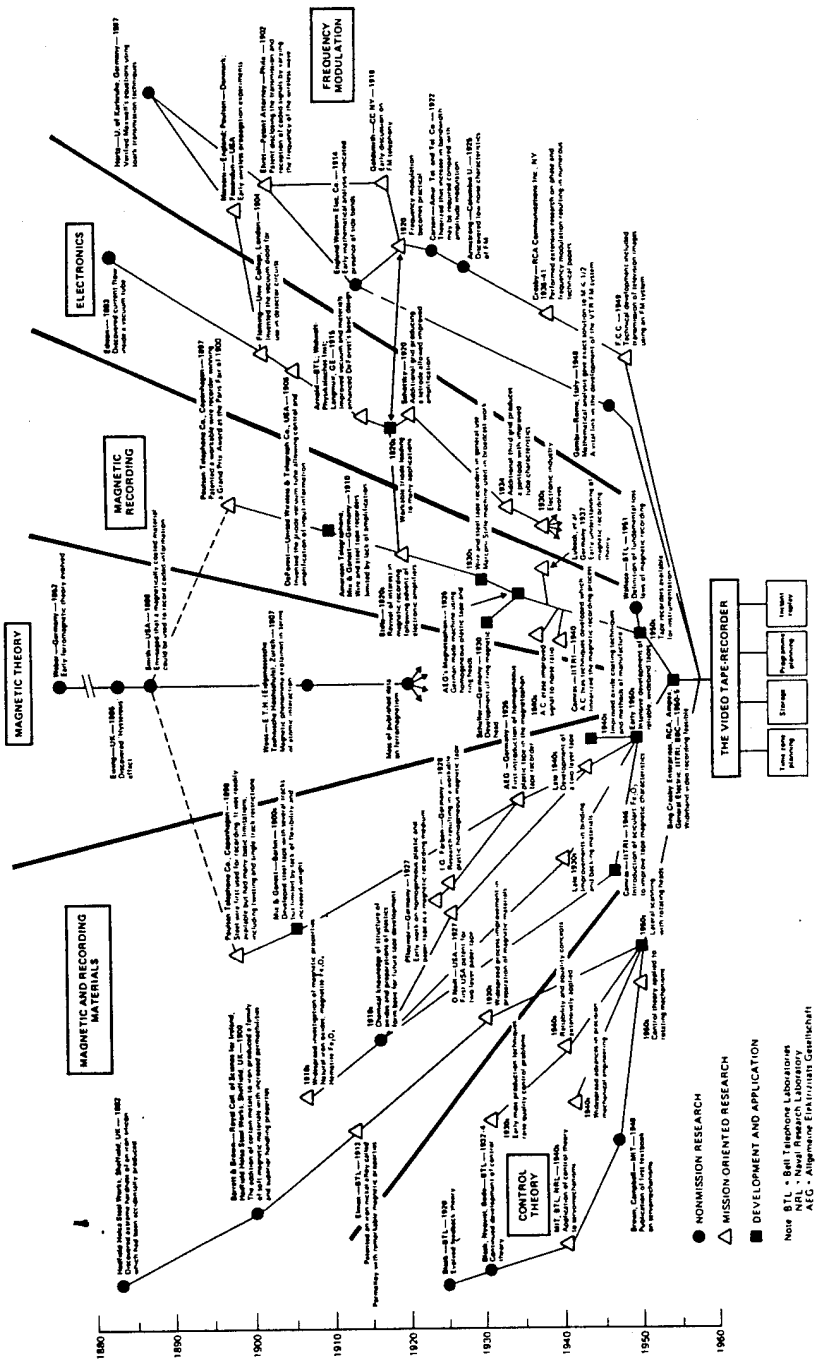


Figure 2. The Research Origins of the Video Tape-Recorder [9]

[9] Ibid., p. 19.

electro-magnetic waves, magnetics, power sources, material science, and timing circuits. A re-examination of both the atomic bomb and vacuum tube computer reveal that these also show these same characteristics. Mission-oriented research was the primary stimulus for development of the atomic bomb in the few years prior to its completion. In the case of the vacuum tube computer, Thomas Edison's discovery of current flow inside a vacuum tube in 1883 was not part of an effort to develop a computer. The determination of science-push or demand-pull is primarily a factor of how far back the origin of a given innovation is traced.

## D. THE INNOVATION PROCESS

In his book, *The Wizard War*, Professor R. V. Jones, the scientific advisor to Winston Churchill during World War II, outlines the steps that a new weapon proceeds through before it is adopted by the military services:[10]

1. General scientific research of an academic or commercial nature occurs which causes
2. Someone in close touch with a Fighting Service, and who is aware of Service requirements, to think of an application of the results of academic research. If this application be considered promising
3. Ad hoc research and small-scale trials are performed in a Service laboratory. If these are successful
4. Large-scale Service trials are undertaken; which may lead to
5. Adoption in Service.

These steps concur with numerous studies on innovation conducted during the 1960s and 1970s.[11] Michael Handel, in his book *War, Strategy, and Intelligence*, adds a sixth stage to this process -- use in battle.[12] The entire process is depicted by the following diagram:

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[10] R. V. Jones, *The Wizard War*, (New York: Cowar, McCann & Geoghegan, Inc., 1978), p. 73.

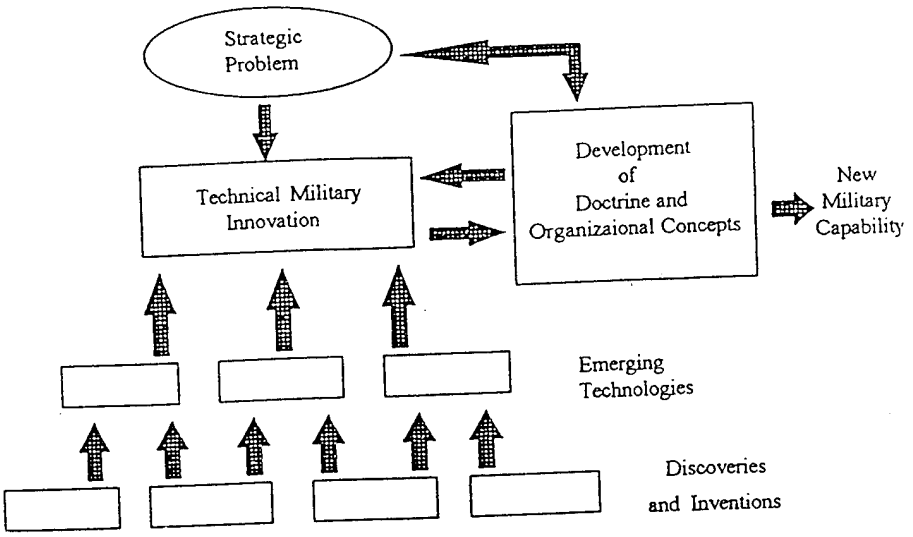


Figure 3. The Military Technical Revolution Concept Applied to Unsolved Military Challenges[13]

### 1. Discoveries and Inventions

In the *Discoveries and Inventions* stage, intellectual breakthroughs are made in a fundamental area of science or physics. This stage is characterized by the following:[14]

- Work of men of genius
- The discoveries were in the realm of pure science
- The time of the breakthrough was unpredictable

### 2. Emerging Technologies

In the *Emerging Technologies* phase, the discoveries and new theories are translated into a device that appears to have some usefulness. This usefulness is not specific to military applications. Characteristics of this phase include:[15]

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[11] Gerald Zaltman, Robert Duncan, and Johnny Holbek, *Innovations and Organizations*, (New York: John Wiley & Sons, 1973), p. 61.
[12] Michael I. Handel, *War, Strategy, and Intelligence*, p. 161.
[13] Strategic Assessment Center of Science Applications International Corporation, *The U.S. Navy Roundtable on the Revolution in Military Affairs*, (Washington, D.C.: Science Applications International Corporation, July 1994), Tab "D".
[14] Stefan T. Possony and J. E. Pournelle, *The Strategy of Technology*, (Cambridge, Mass.: University Press of Cambridge, Inc., 1970), p. 45.

- It is a creative art as much as a science
- It both exploits and supports science
- The invention is in the realm of technology, not pure science

### 3. Technical Military Innovation

In the *Technical Military Innovation* stage, the potential importance of the emerging technology is recognized and resources are allocated to translate the invention into a product that is materially useful. The importance of the technology is in relation to a specific problem. Characteristics of this stage include:[16]

- A decision is made based on recognition of the importance of a scientific principle or invention
- The choice has major implications on future capabilities
- The decision usually leads to a production decision

### 4. Development of Operational Concepts

In the *Development of Operational Concepts* stage, the chosen innovation is developed as a system. Concepts and doctrine are developed to maximize the usefulness of the new capability. New organizations may have to be formed to operate and maintain the innovation. Characteristics of this stage include:[17]

- Exploits the realm of engineering and technology, not science
- It is a deliberate product of technology with a useful purpose in mind

### 5. New Military Capability

The New Military Capability stage completes the process. Appropriate numbers of the new technology are developed so that the innovation can be fully exploited.

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[15] Ibid., p. 46.
[16] Ibid., p. 47.
[17] Ibid., p. 48.

### 6. The Effect of Political and Economic Systems

The steps outlined by Professor Jones do not depend on a particular style of government or economy. However, individual steps may benefit or be hindered by a particular social-economic system. As noted by Matthew Evangelista in Innovation and the Arms Race, "students of innovation have found that centralization tends to be negatively associated with innovativeness; that is the more power and control are concentrated in an organization, the less innovative the organization is."[18] However, Evangelista later notes that "although a centralized system tends to inhibit innovation, it partly compensates for that problem by an ability to marshal resources behind new projects, once a decision is made."[19]

## E. FOCUSING INTELLIGENCE EFFORTS

Lessons drawn from the previous examination of innovation strongly suggests that the best area to focus intelligence collection efforts to determine if a potentially hostile country is developing a MTR is Professor Jones' steps two and three. These steps correspond to *Emerging Technologies* and *Technical Military Innovation* of figure (2). Even discovery of hostile MTR capabilities as late as step three may not provide any workable options. The atomic bomb underwent only one "small scale" trial at Trinity, New Mexico a few weeks before being used at Hiroshima and Nagasaki.

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[18] Matthew Evangelista, *Innovation and the Arms Race*, (Ithaca, New York: Cornell University Press, 1988), p. 29.
[19] Ibid., p. 30.

Intelligence efforts focused on stage one, "Discoveries and Inventions," would waste limited resources by tracking unknown entities. At this stage the nature of the breakthrough or potential capabilities of the innovation is not likely to be known, even to the inventor. Additionally, the intellectual breakthrough may not prove relevant to any military problem. Thus concerted attempts to predict a breakthrough or specific military consequences at this point would waste limited resources and likely produce an unacceptable number of false alarms.

If intelligence efforts are focused on step 4, when large-scale service trials begin and doctrinal and organizational concepts are developed, it is likely that the newly gathered information may be irrelevant because it is simply too late. Recall, a RMA requires only that the enemy be unable to counter the new capability, not be unaware of it.

## F. INDICATORS OF A TECHNICAL REVOLUTION

Given that the focus of intelligence efforts should be on emerging technologies and the initial stages of military innovations, indicators of MTR efforts in these areas must be developed. The indicator lists for each country will likely contain many of the same items. However, these list should not be identical. Different countries have different available resources, different areas of expertise, and exist in different strategic environments. Any occurrence of mirror imaging a country's technical interest and capabilities or dismissal of an interest as "unworthy of consideration" is done at great peril. This is a sure path to the problems of surprise and intelligence failures that were discussed in the previous chapters.

With those thoughts in mind, the following are steps to be taken that can serve as indicators of a developing MTR:

### 1. Identification and Monitoring of Critical Technologies

Beginning in 1989, the U.S. Department of Defense (DoD) was required to submit an annual Critical Technologies Plan to Congress.[20] This plan attempts to identify the "critical technologies" that "are most essential to develop in order to ensure the long term qualitative superiority of United States weapon systems." Once a critical technology is identified, it must be monitored to detect significant breakthroughs. The implication of the new capabilities offered by the breakthrough must then be evaluated by both scientist and weapon experts.

#### a. Criteria for critical technologies

As previously stated, the *Critical Technologies Plan* was developed for the purpose of furthering U.S. technological developments, not for detecting potential developments by other countries. However, the rationale for selecting critical technologies can be applied to any country. Critical technologies were selected on one or more of the following criteria:[21]

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[20] This requirement was first levied by Public Law 100-456, *The National Defense Authorization Act for Fiscal Year 1989*. The report was prepared by the U.S. Department of Defense (DoD) for the Committees on Armed Services of the United States Congress and initially issued 15 March 1989. A revision was issued on 5 May 1989.

[21] These criteria were taken from U.S. Department of Defense, *Critical Technologies Plan* that was prepared to fulfill the requirements of Public Law 101-189 of November 29, 1989. The report was prepared by the U.S. Department of Defense for the Committees on Armed Services of the United States Congress and was issued on 15 March 1990. The only difference from the 1989 version was the addition of "Multiple Use Criteria."

Performance

1. Technologies that enhance the performance of conventional weapon systems.
2. Technologies that provide new military capabilities.

Quality Design Criteria

1. Technologies that improve weapon systems availability and dependability
2. Technologies that improve weapon systems affordability

Multiple Use Criteria

1. Pervasiveness in major weapon systems
2. Strengthening the industrial base

**b. U.S. critical technologies**

The following are 20 technologies identified as critical to the United States military by the Department of Defense:[22]

- Semiconductor materials and microelectronics circuits
- Software producibility
- Parallel computer architectures
- Machine intelligence and robotics
- Simulation and modeling
- Photonics
- Sensitive radars
- Passive sensors
- Signal processing
- Signature control
- Weapon system environment
- Data fusion
- Computational fluid dynamics
- Air-breathing propulsion
- Pulsed power
- Hypervelocity projectiles
- High energy density materials
- Composite materials
- Superconductivity
- Biotechnology materials and processes

[22] Ibid., p. 5.

### 2. Confluence of Distinct Lines of Research

As the video tape-recorder example showed, when two or more distinct lines of research merge, revolutionary capabilities can result. Admiral Owen's vision of a future RMA based on dominant battlespace awareness would likely depend on the confluence of several of the above critical technologies. The merger of a highly efficient air-breathing propulsion system, machine intelligence and robotics, sensitive radars, passive sensors, signature control, and advanced signal processing capabilities would yield a stealthy reconnaissance platform with a long on-station time that could detect any enemy movement in a given area and relay that information instantaneously to a combat operations center.

### 3. Merger of Existing Technologies

A country may use a combination of several existing technologies to develop a new capability. This is much less expensive than the broad research and development efforts referenced in the previous indicator and does not depend on the fickle nature of technological breakthroughs. In addition, expertise is required in a relatively limited area. The U.S. Navy's development AGM-123 "Skipper" rocket-powered laser guided bomb provides a small scale example of how existing technologies being used by front-line units can be reconfigured to provide a weapon with significantly enhanced capabilities.[23] The skipper combined a free-fall "dumb" bomb, laser tracking technology, and a rocket motor. Again, all items were taken directly off the shelf. Only the bomb and laser tracker were being used as a system. The addition of a rocket motor doubled the range of the weapon,

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[23] *Janes Weapon's Systems: 1986-87*, (London: Jane's Publishing Company, Ltd., 1987), p. 189.

allowed for its employment using tactics which greatly enhanced the launch aircraft's chances of survival, and maintained the inherent accuracy of a laser-guided "smart" bomb. Because the process used existing rounds, the cost of the "new" system was greatly reduced -- showing that innovation does not need to be expensive.

**4. Simulation of Future Capabilities in War Games.**

In addition to enhancing proficiency with current weapons, war games offer the military an opportunity to identify the potential of new capabilities before the expense of time and money is made. In exercises conducted by the U.S. Navy during the 1920s, observation planes from the battleships and cruisers were used to simulate carrier aircraft. When the newly constructed aircraft carriers *Lexington* and *Saratoga* were commissioned in the late 1920s, many concepts for their use had already been developed.[24]

Similar efforts are ongoing today. In 1992, following Desert Storm, the United States Army began experiments with a completely digitized battlefield. These efforts have been named by General Gordon Sullivan , Army Chief of Staff, the *Louisiana Maneuvers* after exercises conducted by General George Marshall in 1940-41. In a Keynote address to the Global Panel of Maastricht, the Netherlands, on 17 November 1994, General Sullivan detailed efforts to employ the capabilities of new information age technologies on the battlefield.

> Under the aegis of Louisiana Maneuvers, last spring we created a prototype digitized task force and exercised it at our National Training Center [Fort Irwin, California]. We put digital electronics on our tanks, howitzers, trucks -- everything in and connected to about a 700-man force.

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[24] Norman Polmar, *Aircraft Carriers: A Graphic History of Carrier Aviation and Its Influence on World Events*, (New York: Doubleday & Company, Inc., 1969), p. 54.

And we connected them all together.

We created a force empowered by information. We looked at it operating under difficult conditions, collected data, and we talked with each other about what we saw. . . . It was an enormous success because it enabled our people to see what truly could be. . . . We have created other experiments and demonstrations to force people from traditionally isolated sectors to get together, find common ground and seek solutions to hard problems.[25]

### 5. Identification of the Genius

History has shown that dramatic increases in technology and military capabilities often hinge on the genius of a single person. To some extent this was true of Robert Oppenheimer and his direction of the Manhattan Project . This recognition of Oppenheimer is not meant to discount the vital contributions made by many other brilliant scientists and physicists in the effort to develop the atomic bomb. However, Oppenheimer's genius as both a scientist and an administrator was instrumental to the project's success. A more concrete example of how technology can depend on a single person is the attempt by Iraq to develop a "super gun" that could fire a projectile hundreds of miles. This effort was directed by Gerald Bull. Unfortunately for the Iraqis, Bull was assassinated before the gun could be completed.[26]

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[25] This 17 Nov. 1994 speech by General Sullivan is printed in *Defense Issues,* (Washington, D.C.: Armed Forces Information Service, Vol. 9, No. 91)

[26] A complete account of Gerald Bull and his efforts to develop a supergun can be found in James Adams, *Bull's Eye: The Assassination and Life of Supergun Inventor Gerald Bull,* (New York: Times Books, 1992)

### 6. Monitoring Research and Development Efforts

This effort would identify and monitor several indicators of interest in new technologies and where that interest may lie. Such indicators would include:[27]

- Long-term R & D funding and direction
- Patent applications and grants
- Successful innovations in the civilian sector
- Quality and focus of the national education system
- Number of scientists, engineers, and technology specialists
- Technology information acquisition and exchange

[27] James R. Fitzsimmonds, *The Revolution in Military Affairs: Challenges for Defense Intelligence*, (Washington, D. C.: Consortium for the Study of Intelligence, 1992), p. 28.

# V. RECOGNIZING DOCTRINAL REVOLUTIONS

## A. WHAT IS DOCTRINE

Arguably the most important element in achieving a revolution in military affairs is the formation and optimization of doctrine. It is doctrine that dictates how the available and emerging technologies will be employed and it is doctrine that organizations will be optimized to support. Michael Mazarr recognizes this in his report on RMAs:

> A revolution in warfare will occur only when the potential of new technologies is harnessed under the guiding principles of a new war-fighting doctrine. The full potential of mechanization, air power, and radio communications, for example, was not realized until applied by the Germans in a doctrine of blitzkrieg warfare. The aircraft carrier did not realize its full potential until it was applied under a distinct naval doctrine that rendered the battleline obsolete.[1]

### 1. Definition

The number of definitions for the term "doctrine" is only exceeded by the number of interpretations of its meaning. It is often used as a synonym for terms such as: theory, idea, principle, belief, and concept. Therefore, to offer a single definitive definition is virtually impossible. However, by examining a few of the definitions and attributes of doctrine an appreciation for its meaning and importance can be reached.

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[1] Michael J. Mazarr, *The Military Technical Revolution*, (Washington, D.C.: Center for Strategic and International Studies, 1993), p. 33.

The term *doctrine*, by itself, refers to *a theory based on carefully worked out principles and taught or advocated by its adherents.*[2] It is not dogma, which is indisputable and not subject to debate. Therefore, *military doctrine* refers to a theory on how a military should act. These actions are based on carefully worked out principles and advocated by persons who have a professional interest in the military -- primarily soldiers and statesmen. The following definitions are the official statements by the United States and the former Soviet Unions on what is military doctrine:

> Doctrine is the fundamental principles by which military forces guide their actions in support of national objectives; doctrine is authoritative but requires judgment in application.
>
> U.S. Army Training and Doctrine Command, 1994

> Doctrine is . . . an officially accepted system of views in a given state and in its Armed Forces on the nature of war and methods of conducting it and on preparation of the country and army for war.[3]
>
> Marshal A. A. Grechko, Minister of Defense, 1974

> . . . doctrine provides a military organization with a common philosophy, a common language, a common purpose, and a unity of effort. Doctrine influences, to a major degree, strategic thinking as well as the development of weapons, organization, training, and tactics. Doctrine is the cement that binds a military organization into an effective fighting unit. . . . This doctrine includes not only the tactical employment of forces . . . but also the fundamental principles or tenets of Army thinking. These concern such matters as the strategic conditions under which Army forces should be employed, the relation of these forces to those of other services, the operational environments of the field forces, and the basic principles

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[2] David B. Guralnik, ed., *Websters New World Dictionary*, (New York: The World Publishing Company, 1970), p. 414.

[3] A. A. Grechko, *Vooruzhennyye Sily Sovetskogo Gosudarstva* [Armed Forces of the Soviet State], 1st ed. (Moscow: Voyenizdat, 1974) p. 120 in Scott and Scott, *Soviet Military Doctrine: Continuity, Formulation, and Dissemination*, (Boulder, CO.: Westview Press, 1988), 74.

> which govern operations . . . . In this sense, we might consider doctrine as an Army creed which spells out the way we view our purpose in life and our relation to others.[4]
>
> General George H. Decker, U.S. Army Chief of Staff, 1962

The first two definitions are, at the same time, similar and different. Each attempts to address doctrine's "what" questions -- what forces to use, what entities to attack, what is the nature of the war, what are the objectives. The significant difference is the level of command at which the doctrine must be followed. The United States explicitly grants authority to the military commander to disregard the accepted fundamental principles if and when the situation dictates. By not explicitly granting this authority to the military commander, the former Soviet Union reserved this right for the state. The extended definition offered by General Decker is useful because it outlines how pervasive doctrine is in everything that the military does -- from planning to execution.

**2. Types of Military Doctrine**

Many qualifiers other than "military" are used preceding doctrine to indicate what specific principles are being addressed. "Nuclear doctrine" refers to fundamentals of acquiring and using nuclear weapons. Since the mid-1940s, expressions such as "Mutual Assured Destruction" (MAD) and "Flexible Response" have been used to describe different nuclear doctrines. To provide guidance when nuclear weapons are not likely to be used, several conventional doctrines exists such as the U.S. Air-Land-Sea joint forces doctrine or Low Intensity Conflict (LIC) doctrine. Within the military of a given country,

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[4] This quote was from an unspecified speech by General George H. Decker, former U.S. Army Chief of Staff. The text can be found as an untitled inset piece in *Military Review*, (July 1962), p. 7.

each of the individual services has a doctrine to outline principles that they expect to operate under, i.e. army, naval, or air force doctrine. Entities within the individual services also have their own doctrine, both written and unwritten. For example, the U.S. Navy has separate principles for the employment of submarines, amphibious forces, and aircraft carrier battle groups.

## B. ATTRIBUTES OF EFFECTIVE DOCTRINE

The existence of a written doctrine is no more the "proof" that it is acceptable than the existence of an arms control treaty is "proof" of the effective arms control. For this reason, attributes, or measures of effectiveness (MOEs), are needed to verify the that the accepted doctrine can be implemented and that it supports the nation's strategic objectives. The following are several attributes of effective doctrine:[5]

### 1. Success in Combat

Success in combat is the only true measure of effective doctrine. Anything less should not be acceptable. This may seem to be an overly obvious, but doctrines are subject to many factors other than viability in combat. For example, two reasons for building the next generation of nuclear attack submarines is to maintain the industrial expertise and promote competition between shipyards. Neither is a direct consideration of the strategic

[5] The following five attributes of effective doctrine were taken from Dr. James J. Tritten, *Lessons and Conclusions From the History of Naval and Military Doctrine Development*, (Norfolk, Virginia: Naval Doctrine Command, 1995), p. 18-19.

environment or the needs of the U.S. Navy, but those reasons were used to justify the submarine's construction.

**2. Acceptability by the Military and Nation**

Any doctrine is worthless unless it is acceptable by both the people directing the action and those performing the required tasks. To paraphrase Wayne Hughes from *Fleet Tactics*, "Doctrine isn't what is written in books; it is what statesmen and warriors believe in and act on.[6] If either side does not support a given doctrine and performs acts inconsistent with the tenets of the doctrine, disunity of action will result and the entire endeavor is likely to fail and unwanted consequences will occur. The interaction between Secretary of Defense McNamara and Admiral Anderson, Chief of Naval Operations (CNO), during the Cuban Missile Crisis illustrates this point:

> Soviet ships that had been approaching the U.S. naval blockade of Cuba had stopped dead in the water, apparently not wishing to challenge the exclusion zone. The Navy however was fearful that the ships were rendezvousing with submarines. McNamara, sensing President Kennedy's fears that an unwanted incident could reverse the Soviet's "blink," began to harshly question the CNO on blockade procedures. Picking up the Manual of Navy Regulations, Anderson waved it in McNamara's face and shouted, "It's all in there." To which McNamara replied, "I don't give a damn what John Paul Jones would have done; I want to know what you are going to do now."[7]

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[6] Wayne P. Hughes, *Fleet Tactics*, (Annapolis, Maryland: Naval Institute Press, 1986), p. 28.
[7] Graham T. Allison, "Conceptual Models and the Cuban Missile Crisis," *The American Political Science Review*, No. 3, (1969), p. 539-540.

### 3. Adaptability and Flexibility

Doctrine must be both adaptable and flexible in the face of external threats and internal change. Additionally, an excessively rigid doctrine allows a potential foe to predict with absolute certainty what actions you will take when presented with a given set of conditions. Counters to those actions can be pre-planned in order to inflict maximum harm. Quotes by Lord John A. Fisher, the First Sea Lord of the British Admiralty at the beginning of World War I and Winston Churchill, reveal insight on how dangerous an excessively rigid doctrine, or blind obedience to a particular doctrine, can be:

> Jellicoe, [commander in chief of the British Grand Fleet] had all the Nelsonic attributes except one -- he is totally wanting in the great gift of Insubordination. . . . For all Jellicoe's methodical planning, he could never dispel Churchill's fearful admonition: He was "the one man who could have lost the war in an afternoon.[8]

As it turned out, when battle came for Jellicoe at Jutland he would act correctly, but strictly according to the rules, and an opportunity to deliver a decisive blow to the German Fleet was lost.[9] Despite allowing the German Fleet to escape, fears that Jellicoe would lose the fleet and the war were not realized.

### 4. Relevancy

Effective doctrine must be relevant and strongly address the most likely scenarios. Because doctrine affects how an individual nation fights, trains, exercises, organizes, what

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[8] Robert L. O'Connell, *Sacred Vessels*, (New York: Oxford University Press, 1991), p. 159.
[9] Ibid., p. 159.

it buys, and how plans are made, it must be geared toward meaningful problems.[10] Nations may be excused if they are not prepared for the most unlikely of attacks, but it is unforgivable not to address the most likely threats.

5. **Attainability**

Doctrine must be attainable in the face of constraints. Those constraints could be material, such as petroleum or fissile material; personnel, such as numbers of potential soldiers; or political, such as the will of the people in a democratic nation. The ability to drill and train is also needed. This ensures that the desired doctrine can be executed when needed. Without the resources and training, doctrine is unfulfilled wishes of how one would like to operate.[11]

## C. WHY DOES DOCTRINE CHANGE?

A variety of factors can cause military doctrines to change. These factors may act singularly or in combination with each other. When more than one factor is present, they may or may not support each other in providing the impetus to change doctrine or the direction in which change should occur. These changes may or may not support a future RMA.

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[10] Dr. James J. Tritten, *Lessons and Conclusions From the History of Navy and Military Doctrinal Development*, p. 30.
[11] Ibid., p. 19.

### 1. Strategic Objectives

Arguably the most powerful factor that causes military doctrine to change is a change in the strategic objectives of the nation. This logically follows from the initial definition of doctrine -- a guide for military actions in support of national objectives. Objectives must be viewed from a macroscopic level. Doctrine need not change if the strategic objective is changed from conquering country "A" to country "B." In both cases, the aggressor has offensive and expansionist strategic goals. However, if the previous aggressor decides to establish peaceful diplomatic and economic relations with countries "A" and "B", or these two potential victims have significantly different military capabilities, the aggressor is likely to employ different doctrines.

### 2. Strategic Environment

Concurrent with changes in strategic objectives are changes in the strategic environment. As noted in the U.S. Army's doctrine, Force XXI Operations, "Military doctrine must be capable of executing the strategy of its time." The strategic environment takes into account both the total available resources -- economic, social, political, and military -- that a given country possesses and that are arrayed against it.[12] Naval developments during the interior period illustrate effects of different strategic environments. The United States and Japan envisioned a naval war fought in the central Pacific where land-based air would be scarce and bases vulnerable. Japan also considered carriers a complement to the battleships denied it by treaty. Britain, the third of the great

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[12] Trevor N. Dupuy, Curt Johnson, and Grace P. Hayes, *Dictionary of Military Terms*, (New York: The H. W. Wilson Company, 1986), p. 208-209.

carrier-aviation pioneers, did not have the same compelling rationale from investment in carriers for many reasons: (1) the lack of an enemy carrier-based naval air threat in Europe; (2) the presumed availability of land-based air for maritime missions; and (3) the requirement for large surface forces to control the approaches to the British isles and the exits from the Baltic, the English Channel, and the Mediterranean.[13]

**3. Changes in Leadership**

Changes in leadership can mean a radical change in national objectives and thus a change in military doctrine. However, leadership changes are unlikely to lead to revolutionary military capabilities in the near term. This is particularly true for dictatorships where changes in leadership often involve violence and come from the opposite side of the political spectrum. More often than not, drastic changes in government will lead to a marked decrease in military capabilities because the senior officers are either not trusted, retired, or killed, and new officers lack experience. New operational methods require practice, even if existing and familiar equipment is used. Doctrine is something that must be understood and acted on by everyone.

**4. Defeat/Success on the Battlefield**

Until decisively demonstrated on the battlefield, old doctrine is difficult to reject and new doctrine is unlikely to receive widespread acceptance. Graham Allison, in *Essence of Decision* notes the pressure on an organization to innovate following defeat: "Events understood to be serious failures challenge the organization's basic existence. It [the

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[13] Alland R. Millett and Willianmson Murray, *Innovation in the Interwar Period*, (Washington, D.C.: Office of Net Assessement, 1994), p. 567-568.

organization] owes its existence to achievement of a certain purpose. The organization must innovate in a way that achieves the purpose, or it will suffer."[14] Two types of success can drive innovation. First, successful use of a new doctrine by a third party can be the rationale to copy success. Military organizations are infamous for aping the doctrine of the last war. Second, unanticipated successes with a developing doctrine can drive changes to further exploit the newly realized opportunities. Lessons learned during the Spanish Civil War and the invasion of Poland were instrumental in the development of the doctrine used by Germany for the invasion of France.

**5. Change in Technology**

In his treatise titled, "The Influence of Sea Power Upon History, 1660-1883," Alfred Thayer Mahan observed that changes in doctrine are the result of changes in technology. He also laments the time needed for doctrine to catch-up with technology:

> The unresting progress of mankind causes continual change in weapons; and with that must come a continual change in the manner of fighting. . . . The seaman who carefully studies the causes of success or failure . . . will observe that changes in tactics have not only taken place after changes in weapons, which is necessarily the case, but that the interval between such changes has been unduly long.[15]

Mahan incorrectly asserts that technology must precede doctrine. In the mid-1980s when the Strategic Defense Initiative (SDI) was still active, doctrine for its deployment was being

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[14] Graham T. Allison, *Essence of Decision: Explaining the Cuban Missile Crisis* (Boston: Little, Brown, 1971), p. 85.

[15] Alfred Thayer Mahan, *The Influence of Sea Power Upon History, 1660-1883*, 21st ed. (Boston: Little, Brown & Company, 1917).

developed before the goals became feasible. When the program efforts were significantly reduced, the technology for deployment was still lacking.

**6. Change in Available Resources**

A change in doctrine due to changes in available resources can be the result of foreign or domestic actions. The American embargo on sales of scrap iron and war material to Japan in December of 1940 provided incentives for the Japanese to develop a military doctrine that would ensure the ability to acquire these resources.

Beginning in the late 1980s, cuts in the U.S. defense budget forced the individual services to seek new and cheaper ways of training. One solution was the adoption of sophisticated simulation systems into the training doctrine. For example, simulation was used in the North Atlantic Treaty Organization (NATO) exercise Atlantic Resolve 94.[16] During Atlantic Resolve 94, the Synthetic Theater of War-Europe (STOW-E) exercise integrated high-fidelity simulators at three different sites into live air, land and sea exercises. The potential effects that simulated exercises can have on doctrine is evidenced by the U.S. Chief of Naval Operations, Admiral J. M. Boorda's, statement, "Using combat scenarios, not only can we experiment and test new warfighting concepts, but also address anticipated needs and potential technologies to meet them."

New, and more effective doctrine was certainly not a goal in either case when resources were cut. However, as the relatively austere defense budgets of the interwar period demonstrated, and is emerging in the post Cold War era, new solutions are often found

[16] This exercise is described in J. R. Wilson's article "Simulation Bites the Budget Bullet," in *International Defense Review*, No. 28, (April 1995), p. 44-48.

during difficult times. As a result, readiness and capabilities can emerge in better condition than before the cuts.

**7. Enlightened Vision**

Often the enlightened vision and persistence of one or two people can push doctrine in a new and revolutionary direction. This was the case for the development of Blitzkrieg doctrine. General Heinz Guderian championed the German development of fast moving armored warfare during the 1920s and 1930s. His concepts were based on the conceptual writings of the first British armored theorists, Captain B. H. Liddell-Hart and General J. F. C. Fuller. He also studied their reports of the early British experiments.[17]

In the late 1700s and early 1800s, Napoleon's vision and energetic direction enabled the development of corps doctrine, organization, and tactics. It is highly probable that only Napoleon could have made such a system work and, as evidenced by failure in Spain, the result of his absence was defeat.[18]

## D. INDICATORS OF DOCTRINAL CHANGE

The factors that cause doctrine to change logically lead to indicators of new doctrine. As was the case with changes in technology, all doctrinal changes do not lead to revolutionary military capabilities. However, all revolutions in military affairs must

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[17] Barry R. Posen, *The Sources of Military Doctrine*, (Ithaca, New York: Cornell University Press, 1984), p. 208-209.

[18] Martin Van Creveld, *Command in War*, (Cambridge, Massaschusetts: Havard University Press, 1985), p. 62.

incorporate new doctrine. Only through concerted analysis by subject matter experts can the wheat be separated from the chaff.

**1. Use Against a Third Party**

Because effective doctrine requires cohesion of action, and since change always has many detractors, new principles of warfighting are likely to be tried out on a relatively small scale before being fully adopted. Observation of these "minor" engagements as a non-combatant offers the opportunity to determine if new doctrinal concepts are being utilized. Particular attention must be paid to engagements that result in unexpected successes, even if that success is in a narrow or limited area. The lessons learned will be used to further improve doctrine and justify employment on a grander scale. This was the case in the Crimean War, the Franco-Prussian War, and the Russo-Japanese War. [19]

**2. War Games and Exercises**

Similar to the lessons available in observing third parties, war games and exercises offer the opportunities to both validate established doctrine and explore the possibilities offered by new doctrines. Clausewitz, on the usefulness of war games wrote:

> . . . it can give the mind insight into the great mass of phenomena and their relationships, then leave it free to rise into the higher realms of actions. There the mind can use its innate talents to capacity, combining them all so as to seize on what is RIGHT and TRUE as though this were a single idea . . . a response to the immediate challenge rather than the product of thought.[20]

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[19] Steven Metz and James Kievit, *Strategy and the Revolution in Military Affairs: From Theory to Policy*, (Carlisle Barracks, Pennsylvania: U.S. Army War College, 1995), p. 16.
[20] Carl Von Clausewitz, *On War*, (Princeton, New Jersey: Princeton University Press, 1976), p. 578.

No better example of the usefulness of war games in the development of doctrine exists than the U.S. Navy's effort to plan for war in the Pacific.[21] The war games begun in 1911 in anticipation of war with ORANGE (Japan) would foreshadow all U.S. actions during the Pacific portion of World War II. By the early 1920s the games conducted at the Naval War College in Newport, Rhode Island revealed that if the Philippines fell, a single decisive attempt to immediately re-take the islands would likely result in the destruction of the U.S. Fleet. From that point, requirements and doctrine for a protracted island hopping campaign involving yet to be developed capabilities of amphibious landings, underway replenishment, blockade of the Japanese Islands, and aircraft carrier operations all took shape on the game board. Concepts conceived and practiced on the game board were then tested during the annual Fleet Exercises conducted by real ships and airplanes. By 1941 every senior U.S. Naval officer had a similar view of how the war would unfold and what was needed to win -- after all, they had spent their entire professional lives practicing and preparing for it.[22]

### 3. New Manuals and Doctrinal Publications

Doctrine is only effective if all members of the organization are aware of the desired principles and act accordingly. If doctrine changes, new policies must be promulgated so all members have a clear understanding of their responsibilities. If the new doctrine is not

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[21] A complete description of the war games can be found in Michael Vlahos, *The Blue Sword: The Naval War College and the American Mission, 1919-1941*, (Newport, Rhode Island: Naval War College Press, 1980). A description of the Fleet Exercises of the 1920s and 1930s can be found in Norman Polmar, *Aircraft Carriers*, (Garden City, New York: Doubleday & Company, Inc., 1969).

[22] Michael Vlahos, *The Blue Sword: The Naval War College and the American Mission, 1919-1941*, p. 121.

widely distributed and understood, any new endeavors will lack unity of direction. Additionally, the amount of analysis and criticism available for the purpose of improving the doctrine will be limited. In the early 1960s, when the former Soviet Union wanted to inform both the military and civilian populous of the new doctrine based on the superiority of nuclear weapons, the book Nuclear Strategy was published. Written by Marshal Sokolovskiy, former chief of the General Staff, this book described how military forces, the economy, and the entire Soviet population must be prepared for the "eventuality" of nuclear war.[23] In the United States, following the Goldwater-Nichols Department of Defense Reorganization Act of 1986, 100 subject areas were selected for joint doctrine development. By 1994, new doctrine had been formulated and disseminated via joint publications in over half of the selected subject areas.[24] To help achieve the goals of joint operations, these publications are unclassified and widely available to military and civilians alike. Acquisition and analysis of these types of manuals provide an opportunity to ascertain how a potential enemy will fight.

**4. New Orientation of Curriculum in Service Schools**

This indicator is closely linked to that of *New manuals and doctrinal publications*. Both have the goal of promulgating new methods of conducting business, new goals, and the intricacies of new technologies. This change in orientation can take place within the existing infrastructure or may require the establishment of new organizations. For

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[23] Harriet Fast Scott and William F. Scott, *The Soviet Art of War*, (Boulder, Colorado: Westview Press, 1982), p. 158.
[24] Paul Bracken and Raoul Henri Alcal'a, *Whither the RMA*, (Carlisle Barracks, Pennsylvania: U.S. Army War College, 1994), p. 26.

example, after the fall of the former Soviet Union, the orientation of U.S. intelligence training schools had to shift part of their focus to reflect the new strategic environment. An evaluation of the new curriculum and areas of interest would reflect where the military and civilian leaders perceived the next greatest threats and most likely areas of military engagement. Such areas include low intensity conflicts and operations other than war (humanitarian operations). The mission of intelligence is to provide the type of information the war fighter needs to be successful. New organizations were not needed, existing ones had to be re-oriented.

**5. Professional Journals**

Although articles rarely have the impact George Kennan's 1947 "X" essay in *Foreign Affairs,* titled "The Sources of Soviet Conduct," had in framing the doctrine of containment at the start of the Cold War, many new concepts are proposed in professional publications.[25] Professional journals offer the opportunity to propose changes in doctrine, put forth new ideas, stir debate, and elicit feedback without having to take official responsibility. As previously indicated in chapter 2, Marshall Ogarkov's concepts of a future revolution in military affairs were initially published in Soviet professional military journals such as *Red Star* and *Kommunist.* During the mid-1990s, concepts for revolutionary *Intelligence - Strike - Reconnaissance* architectures and Information War have appeared in U.S. professional military publications such as *Military Review, Naval*

[25] Gregg Herken, *Counsels of War*, (New York: Oxford University Press, 1987), p. 47.

*Institute Proceedings*, and *Joint Forces Quarterly*.[26] Most of the proposals will not lead to new doctrine, but a few will. At the very least, the flavor of debate and direction of change can be discerned.

[26] A few of the articles include Admiral William A. Owens, "The Emerging System of Systems," *Proceedings*, Vol. 121, No. 5, issue 1,107 (May 1995), p. 35-39; Edward C. Ferriter, "Which Way Joint Doctrine?" *Joint Forces Quarterly*, No. 8, (Summer 1995), p. 118-119; George F. Kraus Jr., "Information Warfare in 2015," *Proceedings*, Vol. 121, No. 8, issue 1,110 (August 1995), p. 42-45; James R. Fitzsimonds and Jan M. Van Tol, "Revolutions in Military Affairs," *Joint Forces Quarterly*, No. 4, (Spring 1994), p. 24-31.

# VI. RECOGNIZING ORGANIZATIONAL REVOLUTIONS

> There is nothing more difficult to carry out or more doubtful of success, nor dangerous to handle, than to initiate a new order for things. For the reformer has enemies and . . . only lukewarm supporters.
>
> Niccolo' Machiavelli

Organizational revolutions have just as much, if not more, capability to change the nature of warfare than technical or doctrinal revolutions.[1] This truth was most visible following the French Revolution as national armies began to emerge. The successes of Napoleon served to reinforce the importance of organizations. Prior to the French Revolution, armies were made up of undisciplined mercenaries drawn from the dregs of society who would desert unless watched nearly every moment. This need for close control of the soldiers severely limited the size, tactics, and coordinated maneuvers that armies could employ. Following the French Revolution, former subjects of kings became citizens and formed attachments of love and loyalty to their nations. A sense of group identity and loyalty developed.[2] No longer was close control necessary. Napoleon was able to take advantage of this new loyalty and sense of purpose to organize an army that was far superior to any other on the continent.

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[1] Geoffrey Best ed., *The Permanent Revolution*, (Chicago: University Press, 1988), p. 50.
[2] Alexander, *How Great Generals Win*, (New York: Norton Press, 1993), p. 96.

## A. ORGANIZATIONAL MODELS

Because the structure of every government and organizational element are different, conceptual models are useful to help explain their behavior. The models of a "rational actor," "organizational actor," and "bureaucratic actor" developed by Graham Allison in his examination of the Cuban Missile Crisis[3] are particularly useful. Each one of these models has a different disposition toward innovation. An examination of each will show how innovation can be assisted and how it is hindered.

### 1. The Rational Policy Model

The Rational Policy model has policy as a national choice as the basic unit of analysis. The nation or government is conceived as a rational, unitary decision-maker. National security and national interests are the principle categories in which strategic goals are conceived. Various courses of action relevant to a strategic problem provide the spectrum of options. Enactment of each alternative course of action will produce a series of consequences. The relevant consequences constitute benefits and costs in terms of the strategic goals and objectives. Choices are made to maximize the outcome. Therefore, the rational agent will choose the alternative whose results rank highest in terms of goals and objectives.

This model exhibits the characteristics that are most likely to support innovation and a revolution in military affairs, given that the goal is a more efficient and capable military.

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[3] Graham T. Allison, "Conceptual Models and the Cuban Missile Crisis," *The American Political Science Review*, No. 3, (1969), p. 689-718.

This is the best model because, given that the problem and possible courses of action can be accurately defined, the correct solution will emerge. However, some critical capabilities are implied that are difficult to implement. These difficulties are present in all of the models. First, the strategic problem must be definable. This was relatively easy during the Cold War but is much more difficult now. Until the nature of the problem is grasped, direct steps to counter it can not be taken. Additionally, as long as uncertainty exists in defining the problem, choices that keep a wide range of options open are likely to be selected. Second, it is unlikely that all of the consequences, costs, and benefits that a particular course of action entails will be realized when the choice is made. Therefore, a course of action must be constantly adjusted to compensate for these unanticipated results. Finally, the choice that maximizes the outcome in one area, such as defense, may overly burden other areas, such as domestic programs.

**2. The Organizational Process Model**

The Organizational Process model has policy as an organizational output as the basic unit of analysis. The organizational actor is not a monolithic "nation" or "government" but rather a constellation of loosely allied organizations on top of which government leaders sit. This constellation acts only as component organizations perform routines. Each organization perceives problems, processes information, and performs a range of actions in quasi-independence (within the broad guidelines of national policy). In producing outputs, the activity of each organization is characterized by: Constraints defining acceptable performance, sequential attention to goals, Standard operating procedures, Programs and

repertoires, Uncertainty avoidance, Organizational learning and change, and central coordination and control.

Innovation will be significantly hindered by this model. The goals of avoiding uncertainty and the strong desire to apply standard procedures to all problems will reject new ways of approaching and solving a problem. Solutions to problems that are not within the bounds of acceptable solutions are likely to be rejected out right. Therefore, it is virtually impossible for a RMA to emerge from this model since, by definition, a revolution in military affairs requires a solution that is completely different from the standard.

**3. The Bureaucratic Politics Model**

The Bureaucratic Politics model has policy as a political outcome as the basic unit of analysis. The actor is neither unitary or a conglomerate of organizations, but rather a number of individual players. Groups of these players constitute the agent for particular government decisions and actions. The position within the government defines what each player must, and is able, to do. Therefore, it is not the individual that matters but rather the position in government that he occupies. The advantages and handicaps which each player enjoys stem from his position in the government. Outcomes emerge from a struggle between the players to reach a consensus response to the situation. Although this response may be acceptable to the players, it may constitute an irrational solution to the problem.

For a revolution in military affairs to emerge from this model, the structure of the organization must be such that innovative solutions are both accepted and encouraged from all, or at least most, players. In this way, the outcome or the struggle between the players

will be such that innovation will always be favored. The danger in this model is that as a result of the struggle, the direction chosen in which to innovate may be off target and not adequately address the strategic situation.

## B. WHY ORGANIZATIONS CHANGE

The vast majority of information available on organizational change is written from the perspective of a business person or bureaucrat trying to change an organization, not what causes organizations to change. Thus, answers are sought to questions such as: how to stimulate change; when should organizations change; what are the barriers that impede change; how to develop a climate to promote change; and what is the best way to change. However, to better understand organizational revolutions, it is necessary to determine why an organization would need, or want, to change in the first place.[4]

### 1. History

As noted by Andrew Krepinevich, "With rare exceptions, great-power challengers, or a coalition of challengers, historically have arisen relatively quickly to offset a dominant military power. What the United States does, or fails to do, in moving to realize the potentially dramatic improvements in military effectiveness will influence whether potential competitors are deterred from entering the competition as well as how they pursue the

[4] Works that attempt to answer this question include Amir Levy and Uri Merry, *Organizational Transformation: Approaches, Strategies, Theories* (New York: Praeger Publishers, 1986), p. 269-272 and Paul R. Lawrence "Why Organizations Change" in Allan M. Mohraman and others, *Large-Scale Organizational Change*, (San Francisco, CA: Jossey-Bass Inc., 1989), p. 48-61.

competition."[5] Additionally, if history indicates that a challenger will arise, it is imperative that preparations to meet that challenge begin as soon as possible. Failure to do so increases the chances of being unprepared to meet that future challenge -- whatever form it may take.

**2. Possibilities of a New Battlefield**

If, as the Tofflers contend, the way we make wealth is the way we make war,[6] it is possible that a new means of warfare based on the flow and management of information will emerge. The factors of industrial production such as tanks, ships, and airplanes could become less and less a source of power. Additionally, the leader in the flow and management of information is the private sector, not controlled military organizations with limited access. Everyone has access to the new technology, unlike the nuclear revolution which required a large, and highly complex, set of industrial facilities along with technical expertise The technologies required for a technical revolution in information war are more widespread, easy to obtain, and are available at dramatically lower cost than previous sources of military power.

**3. Change in the Environment**

Changes in the environment can create either a calamity or an opportunity. Both can be the trigger that sets off organizational change. Examples of events that can change

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[5] Andrew F. Krepinevich Jr., "Keeping Pace with the Military-Technical Revolution," *Issues in Science and Technology*, Vol. X, No. 4, (Summer 1994), p. 26.
[6] Alvin and Heidi Toffler, *War and Anti-War*, (New York: Warner Books, Inc., 1993), p. 64-68.

organizations due to misfortune include a reduction in funds available to accomplish a given mission and an unexpected innovation or action by a competitor. Events that create opportunities include unexpected successes in a previously neglected area, and an increase in the availability of funds.

**4. Technology**

Changes in technology often present opportunities that require a change in existing organizations, or formation of new organizations, in order to fully exploit the new possibilities. Recall from chapter two, the development of the German General Staff during the mid-1800s was in large part done to exploit the new railways. A new organization was required to achieve maximum efficiency in coordinating the movement of soldiers, weapons, supplies, and trains. The ability to get more soldiers to the front also required changes in both organization and doctrine. Helmut Von Moltke, Prussia's chief of staff, reasoned that the concentration of such forces was "in itself a calamity," for the growth of major formations -- the corps, which now numbered in excess of 30,000 men each -- had made it impossible to maintain any one of them along any given axis of advance.[7]

**5. Political Mandates**

New laws or orders from a country's leadership can force changes in organizations. In the United States, the Goldwater-Nichols Defense Reorganization act of 1986[8] is an

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[7] Martin Van Creveld, *Supplying War: Logistics from Wallenstein to Patton*, (New York: Cambridge University Press, 1977), p. 81.

[8] Goldwater-Nichols Department of Defense Reorganization Act of 1986 (10 USC 161 et. seq. PL 99-433).

excellent example. A goal of this act was to save money and increase the efficiency of the U.S. military by forcing the individual services of the U.S. military to become more interoperable. Although the changes may have occurred without the act, its presence forced the issue.

## C. HOW ORGANIZATIONS CHANGE

Just as simplification was needed to discuss organizational models, simplification is also required to discuss how organizations change. Two different models prove useful in analyzing change. The first model is concerned with the dynamics of the process of change. It involves a six stages and was developed by Larry Greiner. The second model, developed by Harold Leavitt, is concerned with what elements an organization can alter to cause change.

### 1. Dynamics of Change

Larry Greiner and several associates studied eighteen different organizations in an attempt to determine the dynamics of organizational change.[9] The examined organizations included civilian industrial, technical, and non-technical organizations along with an unnamed United States Navy battleship. Particular interest centered on (1) the conditions leading up to an attempted change, (2) the manner in which the change was introduced, (3) the critical blocks and/or facilitators encountered during the implementation, and (4) the

[9] Larry E. Greiner, "Patterns of Organizational Change," in Gene W. Dalton, Paul R. Lawrence, and Larry E. Greiner, *Organizational Change and Development*, (Homewood, Illinois: Richard D. Irwin, Inc. and The Dorsey Press, 1970), p. 213-229.

more lasting results which appeared over a period of time. Figure 4 illustrates the pattern he discerned from organizations which were able to successfully change.

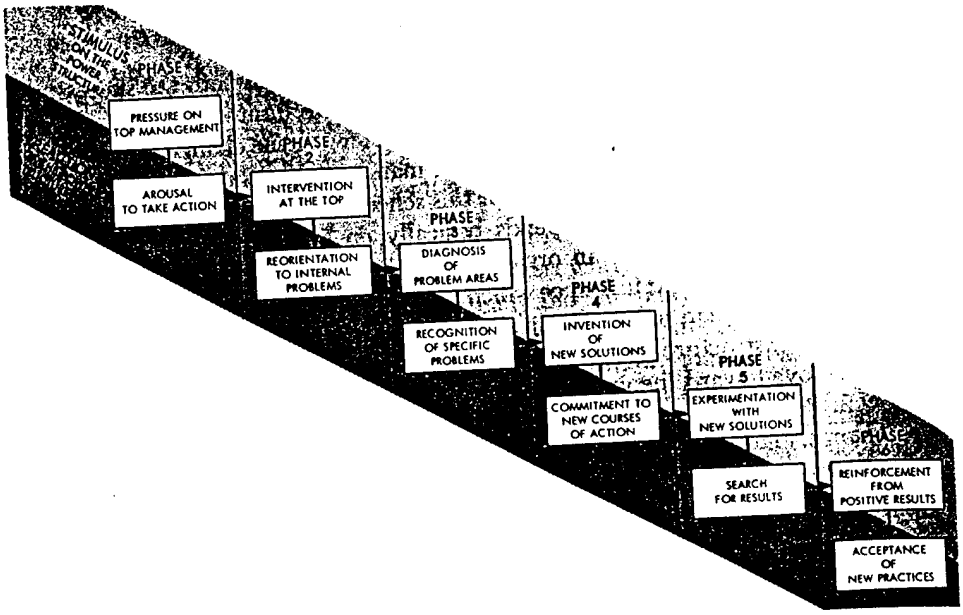


Figure 4. Patterns of Organizational Change

Phase 1: The organization, and especially top management is under considerable external and internal pressure for improvement long before an explicit organization change is contemplated. Performance and/or moral is relatively low. Top management seems to be groping for a solution to its problems.

Phase 2: A new person, known for their ability to introduce improvements, enters the organization, either as the official head or the organization, or as a consultant who deals directly with the head of the organization. An initial act of the new person is to encourage a reexamination of past practices and current problems within the organization.

Phase 3: The head of the organization and their immediate subordinates assume a direct and highly involved role in the reexamination. The new person, with top management support, engages several levels of the organization in the collaborative, fact-finding, problem-solving discussions to identify and diagnose current organization problems.

Phase 4: The new person provides others with new ideas and methods for developing solutions to problems, again at many levels of the organization.

Phase 5: The solutions and decisions are developed, tested, and found creditable for solving problems on a small scale before an attempt is made to widen the scope of change to larger problems and the entire organization.

Phase 6: The change effort spreads with each success experience, and as management support grows, it is gradually absorbed permanently into the organization's way of life.

### 2. Structure of Change

Harold Leavitt developed a model that is useful in examining the variables that interact in an interdependent system to produce change.[10] From his model, various approaches can be developed to affect change.

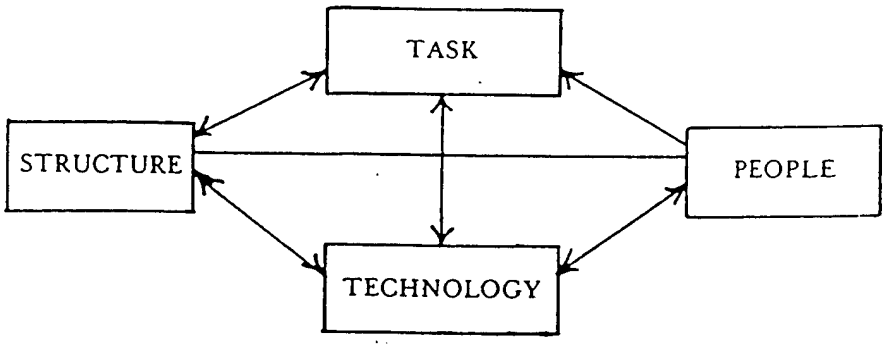


Figure 5. Approaches to Organizational Change

[10] Harold J. Leavitt, "Applied Organization Change in Industry: Structural, Technical and Human Approaches," in W. W. Cooper, H. J. Leavitt, and M. W. Shelly, *New Perspectives in Organization Research*, (New York: John Wiley & Sons, Inc., 1964), p. 55-71.

Leavitt's four interacting variables of change are task, technology, people, and structure. The *task* variable is seen as the primary output or dependent variable, while *people*, *technology*, and *structure* are independent variables that can be used in strategies for organizational change. The term *task* refers to the organization's raisons d'etre or reasons for being. In the case of the military the task is to provide for the nation's defense. The other variables are self explanatory.

The examination of how technology changes was thoroughly explored in chapter four and will not be discussed any further in this chapter. The remaining two independent variables *structure* and *people*, lead to the other two possible approaches to affect change.

**a. Structural Approach**

The structural approach believes that one does not change attitudes and behaviors by teaching new skills, but rather by changing the interactional structure of the organization. Once the structure is changed, attitudes and performance will follow. Although many case studies of organizational change support this approach, at least one significant problem exists: The individuals within the structure are considered constant and interchangeable. Thus their actions will reflect their position in the structure. This coincides with Allison's Bureaucratic politics model previously discussed.

**b. People Approach**

The people approach attempts to effect organizational change through changes in people. The changes are accomplished by attempting to influence attitudes, values and

norms. By changing people, it is argued, one can cause the creative invention of new tools, or one can cause modifications in structure.

### c. Structure and People

An evaluation of both the structural approach and the people approach by Michael Tushman reveals the following: Both approaches to organizational change have shown conditional success. Neither can substantiate itself as the best approach under all conditions. The literature suggests that some combination, some sequence of approaches, may be a more effective way to approach the problem of change. A more general approach would necessarily include both structural and behavioral interventions.

The armies of Napoleon illustrate how both structure and behavior can be factors in organizational revolutions. The sense of loyalty to the state changed the behavior of the soldiers. In conjunction with the change in behavior, a change in organizational structure, in the form of the corps concept, allowed for dramatic improvements in how the task of fighting and defeating the enemy was accomplished. One without the other would have prevented or dramatically lessened the results of their combined employment.

## D. INDICATORS OF ORGANIZATIONAL CHANGE

Using the conclusions gathered from examining why and how organizations change, indicators of these changes can be developed.

### 1. Establishment of New Commands

If new tasks need to be performed, or if old tasks need to be conducted in a new way, often new organizations will be formed to provide this education. This is especially true for technological developments. In the past, establishment of training commands to teach the principles of aviation, submarine warfare, and use of nuclear weapons were all indicative of new capabilities being adopted by the military. Today, principles of technologies such as Synchronous Optical Networks (SONETs), computer network protocols, and Open Systems Interconnection (OSI) need to be understood to fully exploit the possibilities of IW. The establishment of the U.S. Air Force's Information Warfare Center at Kelly Air Force Base, Texas is indicative of new commands attempting to better understand new technologies and the threat they represent. Although establishment of new commands may be more common in response to changes in technology, the recent establishment of the Navy Doctrine Command illustrates that new organizations can emerge when changes in doctrine are being contemplated.

### 2. Creation of New Career Paths

Creation of new and viable career paths that support and promote innovative capabilities are a must if the change is to be successful. In his book, *Innovation and the Modern Military: Winning the Next War*, Stephen Rosen details several examples of how critical it is that viable career paths are required for organizational innovations to succeed.[11]

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[11] Stephen Peter Rosen, *Winning the Next War*, (Ithaca, New York: Cornell University Press, 1991), p. 252-253. Additional examples of the relationship between career paths and innovation can be found in Allan R. Millet and Williamson Murray, *Innovation in the Interwar Period*, (Washington, D. C.: The Office of Net Assessment, 1994).

Those examples include several successful cases such as: U.S. carrier aviation, U.S. Army airmobile divisions, and U.S. Marine amphibious capabilities. Several cases where innovations were less than successful were also examined. Those cases include British carrier aviation and U.S. Army counter-insurgency (CI) capabilities during the early 1960s. In both the successful and unsuccessful cases, the viability of a career path for the organization's up and coming leaders was a decisive factor. The following example of the problems faced by British naval aviators during the interwar period vividly illustrates how failure to account for the importance of a career can doom an innovation.

> The organization of the Fleet Air Arm made it impossible for any Royal Navy officer interested in aviation to pursue that interest without jeopardizing his career as an officer. Any Navy officer who wished to become an aviator had to be attached to the [Royal Air Force] RAF for between three and four years. While with the RAF, it was not clear who would promote him. The RAF had little interest in promoting naval officers within its own ranks, since they would be returning to the Royal Navy. While with the RAF, however, they could not be promoted by the navy. Officers were assured that they would not lose their connection with the Navy while with the RAF, but they discovered that when they did return they were seldom admitted into Navy schools that would train them in traditional naval skills such as navigation and gunnery. Without these basic skills they had little chance of being promoted to the command of a ship.[12]

Today, efforts must be made to ensure a viable career for military officers that desire to specialize in the various aspects of information warfare. Facilities where the information warrior can become proficient and maintain expertise must be established. However, if these efforts result in the centralization of all aspects of IW outside the military or in a joint

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[12] Stephen Peter Rosen, *Winning the Next War*, p. 100.

special organization that has little connection to the individual services, the same problems faced by the Royal Navy will likely result.

### 3. Status of the Leader

The status of an organization's leader and leadership can be critical factor in the ability of an organization to innovate. Apparently in contradiction to each other, both a change in leadership and the longevity of a senior member can be crucial to innovation.

In step two in Mr. Greiner's eight step model of organizational change, a new person either takes command of an organization or becomes intimately involved in determining the direction of the organization. Thus one possible reason for changing leadership in an organization is that a new direction is being sought. This is not always the case, especially in the military where changes in command are routine. However, if changing the direction of the organization is considered vital, the new person can be a rising star and have a distinct and known vision.

At the other end of the spectrum, several case studies suggest the need for an individual to remain at a key post for an extended period of time for an innovation to be successful. During the development of naval aviation, Admiral Moffet served as Chief of the Bureau of Aeronautics (BUAER) from 1921 until his death in 1933. His long incumbency gave him great credibility with individuals who and organizations which were closely involved with the development of naval aviation, such as the General Board, Congress, and senior Navy leadership. This further gave him the ability to protect innovators from interference, and to influence the advancement of junior officers. It may also be important in keeping

innovative ideas and concepts from being stillborn in the event of failures and accidents.[13] The case of Admiral Rickover and the U.S. Navy's development of nuclear power and a strategic arm of the triad, also is indicative of this pattern.[14]

**4. New Structural Relationships**

A change in how entities of an organization are able to communicate and exchange information can be indicative of significant organizational changes. For example, a change in the structure of the U.S. military's Joint Task Force (JTF) could make a difference in the organization's performance.[15] Figure 6 portrays a typical JTF with all of its components on one line, which include: U.S. Army forces (ARFOR), U.S. Marine Corps forces (MARFOR), U.S. Air Forces (AFFOR), U.S. Navy forces (NAVFOR), and Special Operations forces (SOFOR). While this service oriented command structure suffices for personnel management and administration, to fight using these component commanders as operational commanders alone will simply not work. For fighting, the forces must be mixed in a task organization that is designed for the specific mission and situation. Difficulties can result if individual commanders do not control all of the JTF assets relevant to an assigned mission.

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[13] Director of Net Assessment, *Historical Innovation: Carrier Aviation Case Study.* Memorandum for Distribution, (Washington, D. C.: Office of the Secretary of Defense, 24 June 1994).

[14] Two books detailing the career of Admiral Rickover are Norman Polmar, *Rickover,* (New York: Simon and Schuster, 1982) and Theodore Rockwell, *The Rickover Effect: How One Man Made a Difference,* (Annapolis, MD.: Naval Institute Press, 1992).

[15] This example was taken from an article by Lieutenant General John H. Cushman, U.S. Army, Retired, titled "Make it Joint Force XXI" which appeared in *Military Review,* No. 2, (March-April 1995), p. 4-9.

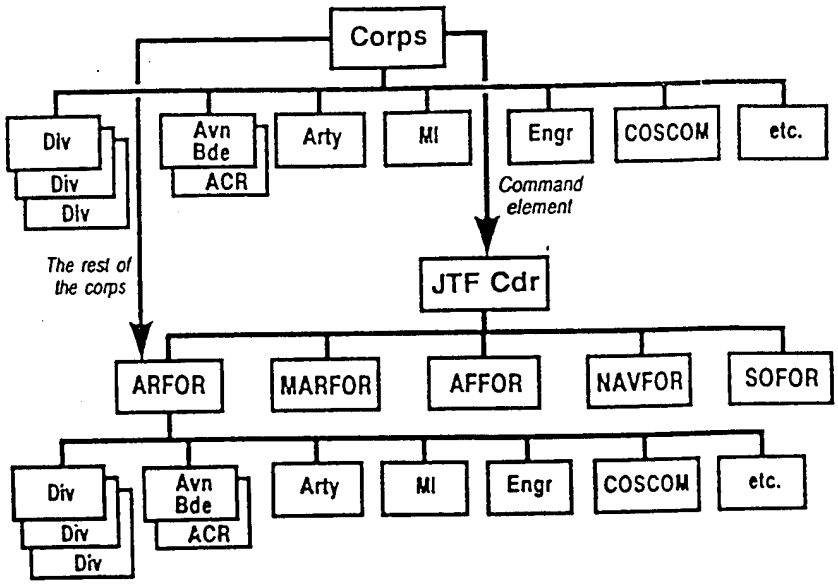


Figure 6. Corps Integration with a JTF

A different JTF organization may have a structure as depicted in figure 6. In this structure the task, or mission, is the prime factor in where individual elements fit into the organization, not which service they come from. Further enhancing this mission oriented

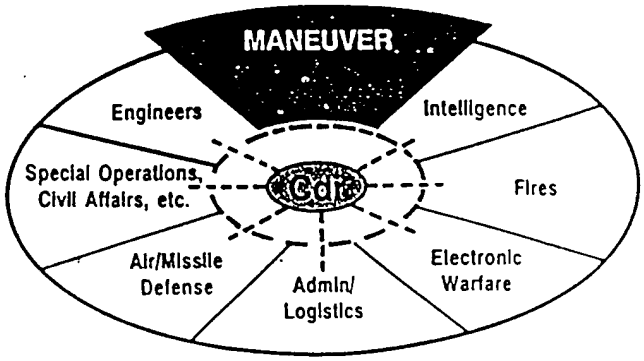


Figure 7. Mission Oriented Command Structure with Maneuver as the Primary Element

command structure could be a free and open information flow that produces common situational awareness and capability for fingertip-touch throughout the force. The information flow would more resemble a bicycle rim with spokes serving as means to extract any needed information than the stove pipes of the current structure.

Changing the structure of the military organization is proposed by Martin Libicki and James Hazlett in an article titled, "Do We Need an Information Corps?"[16] They believe a separate Information Corps would guide the revolution, create a common doctrine for the diverse requirements of information warriors, and facilitate liaison among civilian information agencies. In addition, Libicki and Hazlett state that the traditional relationship between information and force will be turned on its head. No longer will supporting elements such as command and control, logistics, and personnel serve the weapon operators. Instead, information will become the center piece and other units, of which weapon systems are but one, will support the information system.

**5. History of Innovation**

The quote from Machiavelli at the beginning of the chapter recognizes how difficult it is to establish a new way of doing business. However, if an organization develops a record of change and is able to incorporate innovation within its standard operating procedures, it is more likely that future innovations will occur. Unfortunately there is no single formula for promoting organizational innovation. The number of management books and

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[16] Martin C. Libicki and James A. Hazlett are both senior fellows in the Institute for National Strategic Studies, National Defense University. Their article, "Do We Need an Information Corps?" can be found in *Joint Forces* Quarterly, No. 3, (Autumn 1993), p. 88-97.

techniques that are constantly being published are testament to this fact. However, a propensity for self-analysis, self-criticism, tolerance for failure, and a reward system to encourage innovation are traits of every innovative organization.[17]

[17] These traits are contained in an undated brief given by Capt. James R. Fitzsimonds of the Office of Net Assessment titled, "The Revolution in Military Affairs: Challenges for Defense Intelligence," and an undated brief given by Col. Jeff Barnett of the Office of Net Assessment titled, "The Revolution in Military Affairs."

# VII. CONCLUSIONS

Applying indications and warning intelligence methods to the three pillars of a revolution in military affairs, technology, doctrine, and organization, is a significant first step toward forecasting a potentially hostile revolution in military affairs. The general indicators presented in this thesis provide a base on which indicators of a RMA can be identified and expanded upon. Specific indicators for a given country or sub-national group would likely include at least some of the following:

- What are the premier research facilities and the areas being studied?
- Who is in charge of individual research and development efforts?
- What were the concepts and goals of the latest military exercise?
- Which professional journals are most influential and what new concepts are being discussed?
- Who are the rising stars and from which service or community are they coming from?
- What are the areas of intense technical interest?

Once the country specific indicators are developed, an intelligence collection plan is needed to determine how data will be provided to the analysts to assess the status of each indicator. This plan must be continuously monitored to ensure all required data is actually being provided, new targets are added, and irrelevant targets are deleted.

For some countries, only niche RMAs may be possible or sought. Niche RMAs are specific to only a small part of the warfare spectrum. Information warfare offers an excellent opportunity for achieving a niche RMA, especially if the goal is to disrupt an enemy's data flow. Several means of attacking a computer already exist such as Trojan horses, network worms, and logic bombs. Powerful high-speed computers are widely

available and almost anyone can gain access to world wide networks. The seriousness with which the U.S. military takes these possibilities is evidenced by the establishment of a dedicated computer security team to respond to computer attacks against defense department computers and databases and the establishment of information warfare curricula at several professional service schools.[1]

Other more conventional means of warfare also have the potential to become a niche RMA. For example, if a country such as Iran were able to develop a "brilliant mine" that could remain dormant on the ocean floor until a specifically targeted ship (by hull number) was detected, the naval balance of power would dramatically shift. However, this capability would be largely irrelevant to the Air Force and any land operations. Most countries have the capability to achieve a niche RMA if desired, and the source of military power is not constant. For this reason, the development and monitoring of indicators should not be limited to countries that have traditionally been leaders in military technology.

The order in which a change in technology, doctrine, and organization occurs does not in and of itself indicate how close a country is to the realization of an RMA. For this reason, the indicators in all three areas are equally important. However, cultural factors that are particular to a given country may provide clues as to how close a RMA may be. For example, in the former Soviet Union, new doctrine and organizations usually precede new technological capabilities. However, in the United States new doctrine and

[1] Douglas Waller, "Onward Cyber Soldiers," *Time*, Vol. 146, No. 8, (21 August 1995), p. 38-46.

organizations usually follow new technologies. Such cultural factors should be evaluated by area and technical experts, in conjunction with all other data, in making an assessment if a RMA is near. Over reliance on a single factor such as cultural trends invites the surprises discussed in Chapter III. The U.S. Strategic Defense Initiative (SDI) is indicative that the patterns do not always hold.

A number of additional areas in which intelligence interacts with revolutions in military affairs exist, and need to be examined. Many of these areas can be drawn from Professor R. V. Jones and his book *The Wizard War*[2]. Recall, from the beginning of Chapter III, the basis for exploring how to detect a potentially hostile RMA was Professor R. V. Jones' primary goal for scientific and technical intelligence -- to ascertain the development of new weapons and improvements of existing ones by other countries. Professor Jones' other goals include: (1) misleading potential or actual enemies about our own weapons, (2) misleading the enemy about the success of his own weapons, (3) assisting technically in espionage and its counter, and (4) coordinating scientific and technical intelligence between the services.

An additional area of intelligence and RMAs that should be examined is that of determining what new technologies, doctrine, or organizations the intelligence community would need to support the war fighter on the various envisioned battlefields. Early anticipation of the war fighter's needs is a step toward better intelligence support.

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[2] R. V. Jones, *The Wizard War*, (New York: Coward, McCann & Geoghegan, Inc., 1978), p. 74.

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